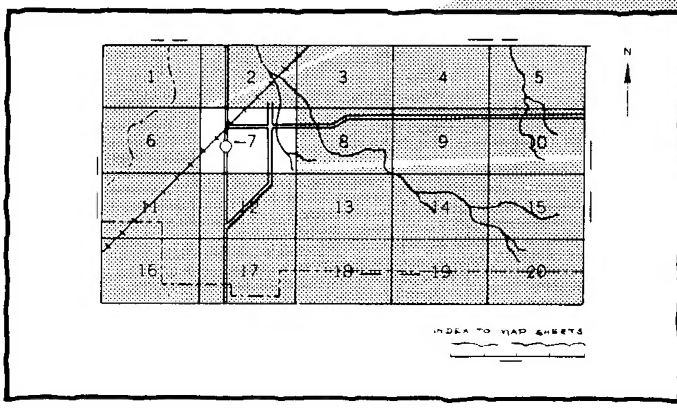
Soil Survey of

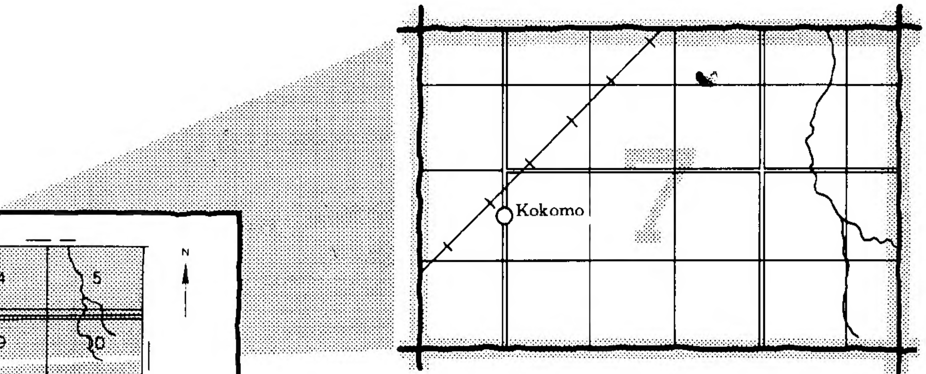
Warren County, Kentucky

United States Department of Agriculture, Soil Conservation Service
in cooperation with
Kentucky Agricultural Experiment Station and
Kentucky Department for Natural Resources and Environmental Protection

HOW TO USE

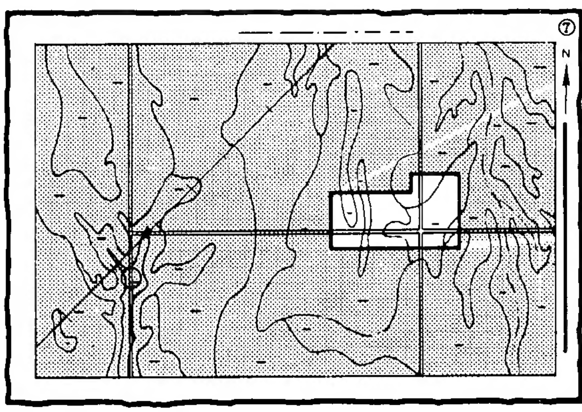
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

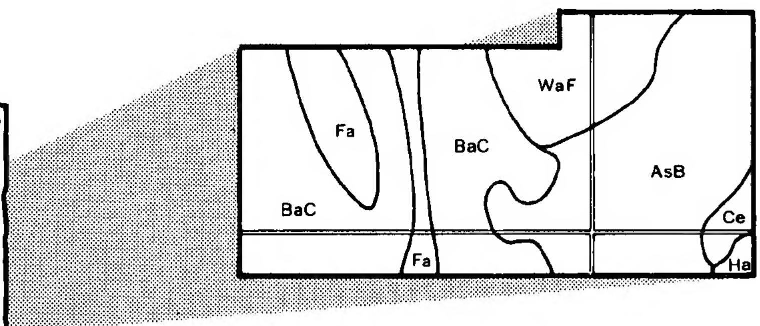




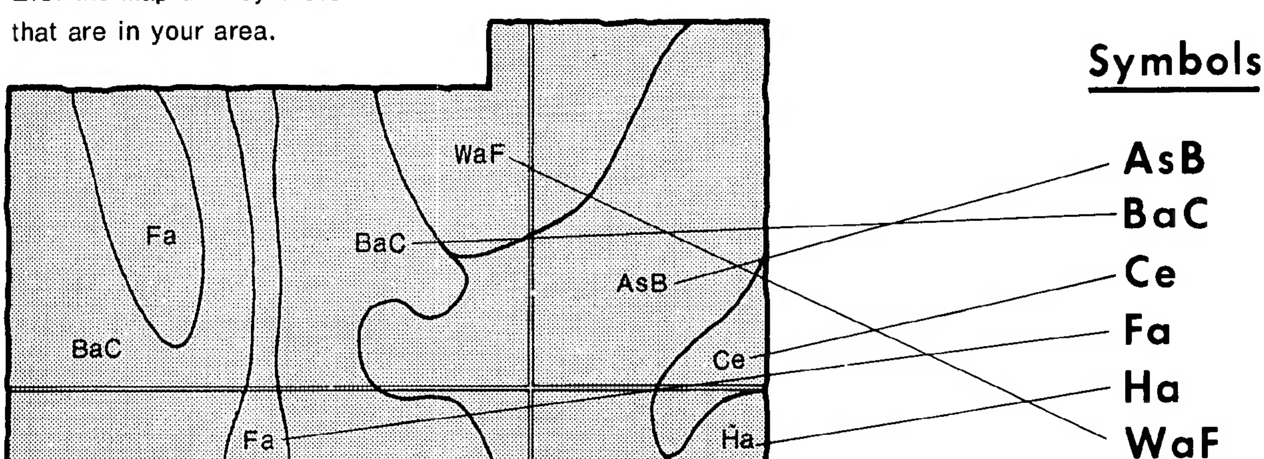
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



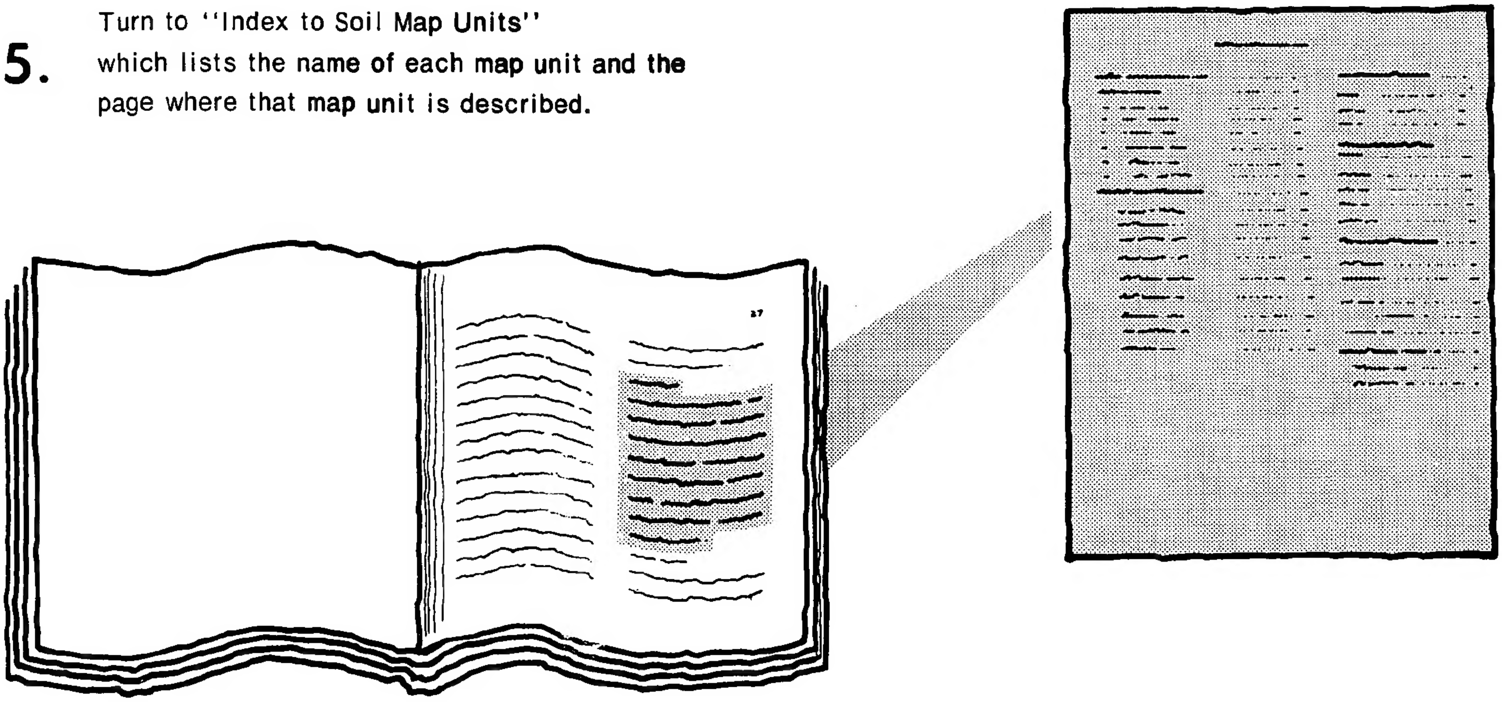


4. List the map unit symbols that are in your area.

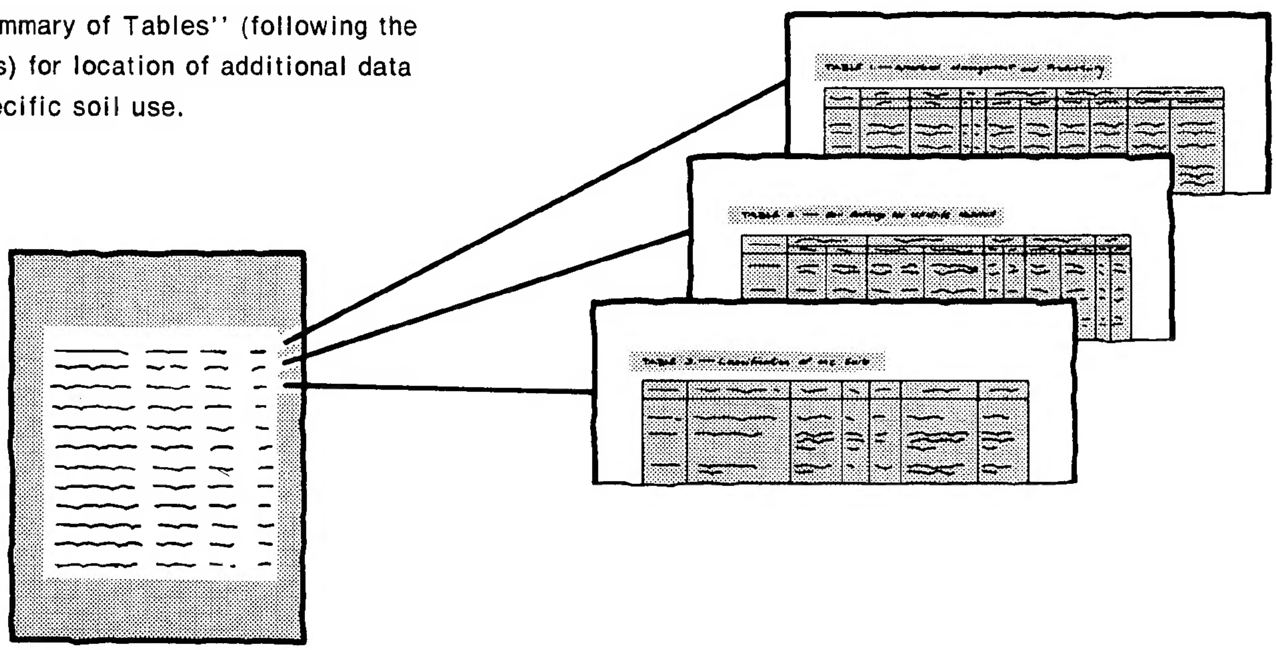


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1973-77. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978. This survey was made cooperatively by the Soil Conservation Service, the Kentucky Agricultural Experiment Station, and the Kentucky Department for Natural Resources and Environmental Protection. It is part of the technical assistance furnished to the Warren County Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

This survey supersedes the soil survey of Warren County published in 1905 (*10*).

Cover: This farmhouse and pasture are in an area of Crider silt loam. This soil is well suited to pasture.

contents

soil series

Issued May 1981

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summary of tables

foreword

This soil survey contains information that can be used in land-planning programs in Warren County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Glen E. Murray
State Conservationist
Soil Conservation Service

Location of Warren County in Kentucky.

soil survey of
Warren County, Kentucky

By Arlin J. Barton, Soil Conservation Service

Soils surveyed by Arlin J. Barton, Jim W. Dye, Michael J. Mitchell
William H. Craddock, and Edward B. Campbell
Soil Conservation Service, and Donnie E. Owen and Donnie W. Holbrook
Kentucky Department for Natural Resources
and Environmental Protection

United States Department of Agriculture, Soil Conservation Service
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Warren County is in the south-central part of Kentucky. It has a total area of about 546 square miles, or 349,440 acres. Bowling Green, the county seat, is near the center of the county. In 1975, the county had a population of about 62,400.

The extreme northern part of Warren County is a steep to undulating broad upland that is characterized by deeply dissected drainageways. Streams flow north to northwest. The rest of the county is mostly undulating to hilly. It is drained by the Barren River, Gasper River, Drakes Creek, and underground streams through depressions in karsty areas.

Farming and industry are the main enterprises in the county. The climate is favorable for cash-grain crops and livestock farming. The main crops are corn, wheat, soybeans, tobacco, hay, and pasture. Industries include the processing of foods, livestock feed, and wood products and the manufacturing of chemicals, clothing, plastics, auto and electrical parts, and heavy equipment.

The soils in Warren County range widely in texture, natural drainage, and other characteristics.

general nature of the survey area

Warren County was formed in 1796 from parts of Logan County. It was named for General Joseph Warren, who died at Bunker Hill during the Revolutionary War.

The county was first settled before the Revolutionary War by pioneers from the more thickly settled states of Virginia and North Carolina. Daniel Boone was one of those pioneers. The increase in population was very slow until the close of the Revolution (*10*). Bowling Green, the first permanent settlement, later became the county seat.

Farming has been important in Warren County since the first settlement was established; however, up to the time of the Revolution little was done to develop the agricultural resources of the area. In the northern and western parts of the county, the settlers found plenty of oak, hickory, redcedar, and other valuable timber. In the southern and central parts they found treeless land, which they called "barrens." At first, the settlers believed that the treeless land was unproductive, and they avoided using it as cropland. Soon, the more progressive farmers found that the soil on that land could produce more corn, tobacco, and other crops than the soils on the forested land. Livestock and wheat also were part of agriculture in the early days.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Bowling Green, Kentucky, in the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last

freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 37 degrees F, and the average daily minimum temperature is 27 degrees. The lowest temperature on record, which occurred at Bowling Green on January 24, 1963, is -21 degrees. In summer the average temperature is 76 degrees, and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred at Bowling Green on July 27, 1952, is 106 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 47 inches. Of this, 23 inches, or 50 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 5.69 inches at Bowling Green on June 23, 1969. Thunderstorms occur on about 60 days each year, and most occur in summer.

Average seasonal snowfall is 11 inches. The greatest snow depth at any one time during the period of record was 12 inches. On an average of 6 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 10 miles per hour, in March.

farming

Farm products and enterprises are the main sources of income in Warren County. In 1974, the U.S. Census of Agriculture (*14*) listed farm sales from crops, including hay, as 9,699,000 dollars and income from livestock and livestock products as 12,564,000 dollars. The total number of farms in the county was 2,328. The average farm size was 114 acres. The farms that had sales of 2,500 dollars or more numbered 1,429. Of those, 78 percent were operated by full owners, 14 percent were operated by part owners, and 8 percent were operated by tenants. Tobacco, corn, soybeans, wheat, and hay were crops harvested. Tobacco, the most important cash crop, is grown on most farms in Warren County. Alfalfa, clovers, and lespedeza are the main forage crops grown in the county.

The nearly level and hilly topography is ideal for row crops and pasture. According to the Kentucky Soil and Water Conservation Needs Inventory (*6*) of 1970, 124,843 acres was used for pasture and 110,221 acres was used for crops in Warren County.

physiography, topography, and geology

Warren County is mostly on the Mississippian Plateau. The extreme northern tip extends onto the Pennsylvanian Plateau (*7*). The county is divided into two physiographic regions. The north-northeastern part of Warren County is in the Western Coal Fields, and the rest of the county is in the Western Pennyroyal Physiographic Region.

The county is drained entirely by the Green River and its tributaries. Green River forms the northern boundary of the county, flowing westward. Barren River nearly bisects the county and forms a junction with Green River in the northwest corner. Drakes Creek flows to the north to junction with the Barren River east of Bowling Green. Gasper River, in the western part of the county, flows northward to junction with the Barren River northwest of Bowling Green.

The topography in Warren County ranges from nearly level to steep. The elevation ranges from 410 feet above sea level at the confluence of the Barren River and Green River to 760 feet in the northeastern part of the county near Benleo.

In Warren County the geologic formations are of the Mississippian and Pennsylvanian periods. The Mississippian rock that underlies the Western Pennyroyal is Girkin, St. Louis, St. Genevieve, Salem, and Warsaw Limestone. The Pennsylvanian rock that underlies the Western Coal Fields is the Caseyville Sandstone (*8, 9*).

Sinkholes, or karst, are characteristic of most of the limestone areas, and they are abundant in Warren County. They have a marked effect on the landscape as they are responsible for the irregularity of the surface of the limestone areas. These sinks are rounded depressions, a few feet to more than 300 feet in diameter, which are formed by the dissolution and removal of limestone by percolating waters, and later by the sinking of the overlying material into the cavity. Water often collects at the bottom of the sinks, and in some places it forms permanent ponds that are often the only source of water for livestock.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in

a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

soil descriptions

1. Newark-Nolin

Deep, nearly level, somewhat poorly drained and well drained soils that have a loamy subsoil; formed in mixed alluvium on flood plains

This map unit is made up of broad, flat river bottoms, stream terraces, and narrow streams (fig. 1). Intermittent streams dissect the bottoms and terraces. This map unit is in the northern part of the county along Green River, and it extends up Barren River to the mouth of Gasper River.

This map unit makes up about 2 percent of the county. It is about 39 percent Newark soils, 20 percent Nolin soils, 41 percent soils of minor extent.

Newark soils are somewhat poorly drained. They are on concave, nearly level bottom lands adjacent to hillsides. They have a surface layer of brown silt loam and a moderately permeable loamy subsoil. The soils are subject to frequent flooding in winter and spring.

Nolin soils are well drained. They are generally on broad, flat river bottoms and are along narrow streams. They have a surface layer of brown silt loam and a moderately permeable loamy subsoil. Flooding is common in winter and spring.

Of minor extent in this map unit are the poorly drained Melvin soils and the moderately well drained Lindside soils on the flood plains and the somewhat poorly drained Lawrence soils, the moderately well drained Nicholson soils, and the well drained Elk soils on the terraces.

On most of the acreage, the soils are used for cultivated crops, hay, and pasture. They are suited to most cultivated crops. The main limitations to farming are the wetness of the Newark soils and flooding. Artificial drainage of the Newark soils can help to overcome the wetness limitation.

The soils in this map unit are suited to most specialty crops. Poor air movement, frost hazard, wetness, and flooding are limitations to some specialty crops, hay, and pasture.

Although most of the acreage is cleared, the soils are well suited to woodland use. The main concerns of woodland management are plant competition and limitations to the use of equipment.

The soils in this map unit are severely limited for urban uses by flooding and wetness.

The soils are poorly suited to intensive recreation uses. Flooding and wetness are the main limitations to those uses.

Nolin soils in this map unit have good potential for use as openland and woodland wildlife habitat. Newark soils have good potential for use as woodland wildlife habitat, and they have fair potential for use as openland wildlife habitat.

2. Frondorf-Ramsey

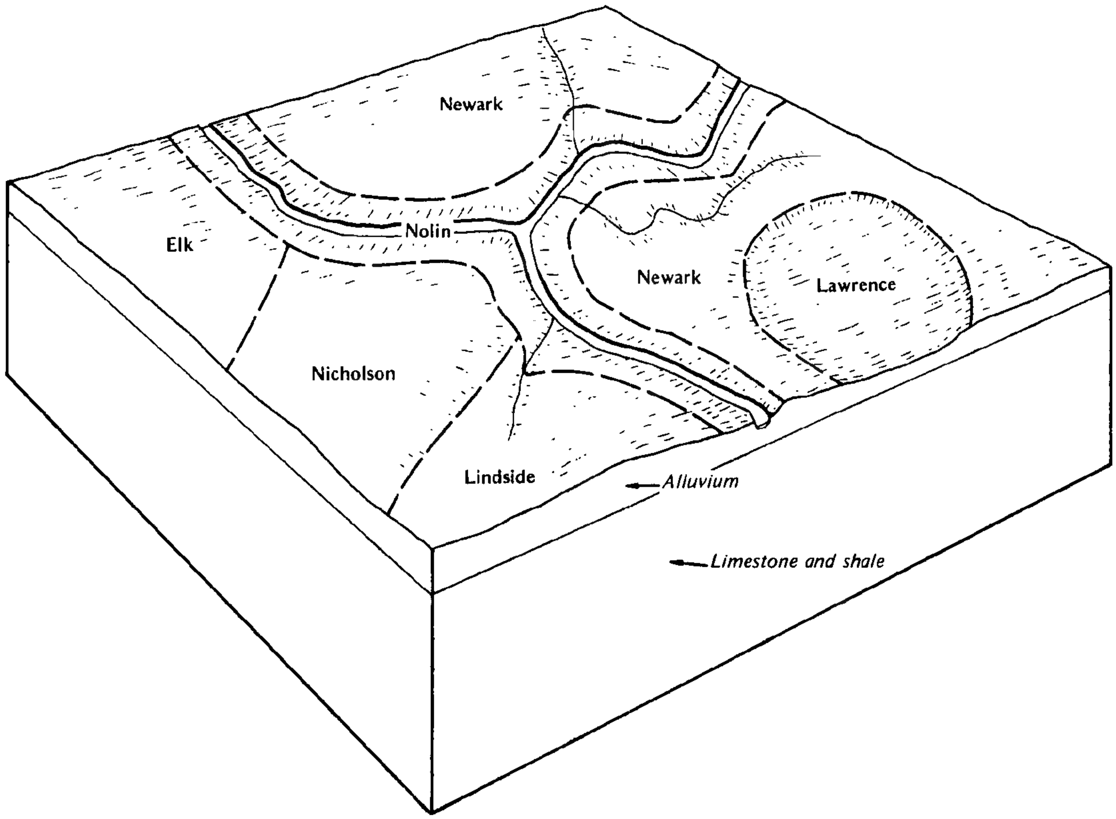
Moderately deep and shallow, sloping to very steep, well drained and somewhat excessively drained soils that have a loamy subsoil; formed in residuum of sandstone, or in loess and the residuum of sandstone and shale on uplands

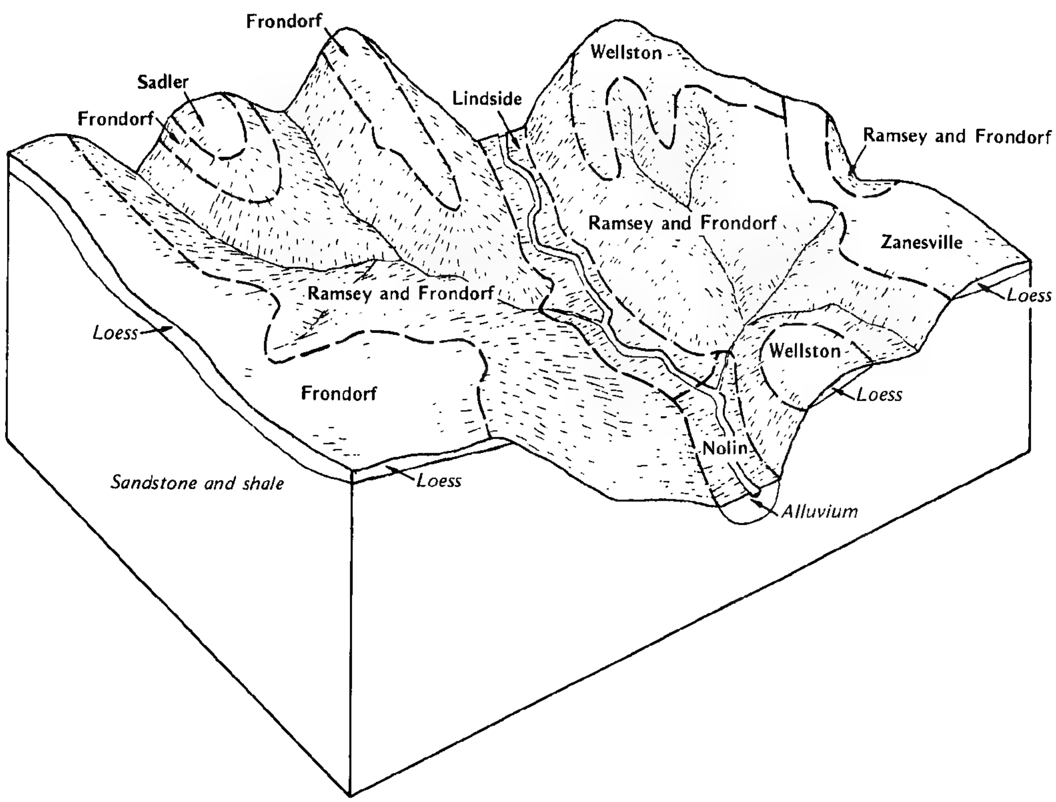
This map unit is in the northern part of the county. It is very steep to rolling hills and ridges (fig. 2). The hills are generally long and irregular in shape. The ridges are long and narrow. This map unit is deeply dissected by rivers, small streams, and drainageways.

This map unit makes up about 6 percent of the county. It is about 44 percent Frondorf soils, 21 percent Ramsey soils, and 35 percent soils of minor extent.

Ramsey soils are on the lower part of hillsides adjacent to the Frondorf soils. They have a surface layer of very dark grayish brown loam. The subsoil is rapidly permeable, channery and loamy material.

Frondorf soils are on the ridges and hillsides adjacent to Ramsey soils. The surface layer is brown silt loam.





Typical pattern of soils and underlying material in the Newark-Nolin map unit (figure 1, top) and the Frondorf-Ramsey map unit (figure 2, bottom).

The subsoil is moderately permeable loamy material that is channery in the lower part.

Of minor extent in this map unit are the well drained Nolin soils, the somewhat poorly drained Newark soils, and the moderately well drained Lindside soils on bottom lands and in narrow drainageways. Also of minor extent are the somewhat poorly drained Lawrence soils on uplands and stream terraces; the well drained to moderately well drained Zanesville soils and the moderately well drained Sadler soils on the broadest ridges; and the well drained Wellston soils on narrow ridges.

On most of the acreage, the soils are used as woodland. On a considerable acreage, however, they are used for pasture. On the less sloping soils, a few cultivated crops are grown. Steepness of slope and depth to bedrock are severe limitations to most farm uses.

The soils in this map unit are poorly suited to cultivated crops, hay, pasture, specialty crops, urban development, and intensive recreation uses. Steepness of slope and depth to bedrock are limitations to those uses.

Ramsey soils have very poor potential for use as openland wildlife habitat, and they have poor potential for use as woodland wildlife habitat. Frondorf soils have good potential for use as openland and woodland wildlife habitat.

3. Zanesville-Sadler

Deep, nearly level to sloping, well drained and moderately well drained soils that have a loamy subsoil that includes a fragipan; formed in loess and the residuum of sandstone, siltstone, and shale on uplands

This map unit is in two discontinuous, irregularly shaped areas in the northern half of the county (fig. 3). The landscape consists of broad flats and narrow ridgetops drained by small streams and waterways.

This map unit makes up about 9 percent of the county. It is about 44 percent Zanesville soils, 9 percent Sadler soils, and 47 percent soils of minor extent.

The gently sloping to sloping, well drained to moderately well drained Zanesville soils are on uplands. They have a surface layer of dark grayish brown silt loam. The subsoil is loamy and has a firm, compact, moderately slowly to slowly permeable fragipan at a depth of 23 to 32 inches.

The nearly level to gently sloping, moderately well drained Sadler soils are on uplands. They have a surface layer of brown silt loam. The subsoil is loamy and has a firm, compact, slowly permeable fragipan at a depth of 18 to 32 inches.

Of minor extent in this map unit are the somewhat excessively drained Ramsey soils and the well drained Wellston, Frondorf, and Caneyville soils on the benches and side slopes. Also of minor extent are the somewhat poorly drained Lawrence and Newark soils and the well drained Nolin soils along the drainageways and in depressions.

On most of the acreage, the soils are used for cultivated crops, hay, and pasture. They are suited to most cultivated crops and a few specialty crops. The main limitations are wetness, slow permeability, the moderately deep root zone, and the erosion hazard.

The soils in this map unit are suited to urban uses. Steepness of slope, slow permeability, wetness, and depth to bedrock are the main limitations to those uses.

The soils in this map unit are suited to woodland use. Plant competition is the main limitation to this use.

The soils in this map unit are suited to intensive recreation uses. The main limitations are steepness of slope, wetness, and slow permeability.

The soils in this map unit have good potential for use as openland and woodland wildlife habitat.

4. Fredonia-Caneyville

Moderately deep, gently sloping to very steep, well drained soils that have a clayey subsoil; formed in residuum of limestone on uplands

This map unit occurs on broad, rolling uplands and steep to very steep hillsides that are dissected by meandering rivers and small streams (fig. 4). The surface area is about 15 to 20 percent small to large limestone boulders, rock ledges, and Rock outcrop.

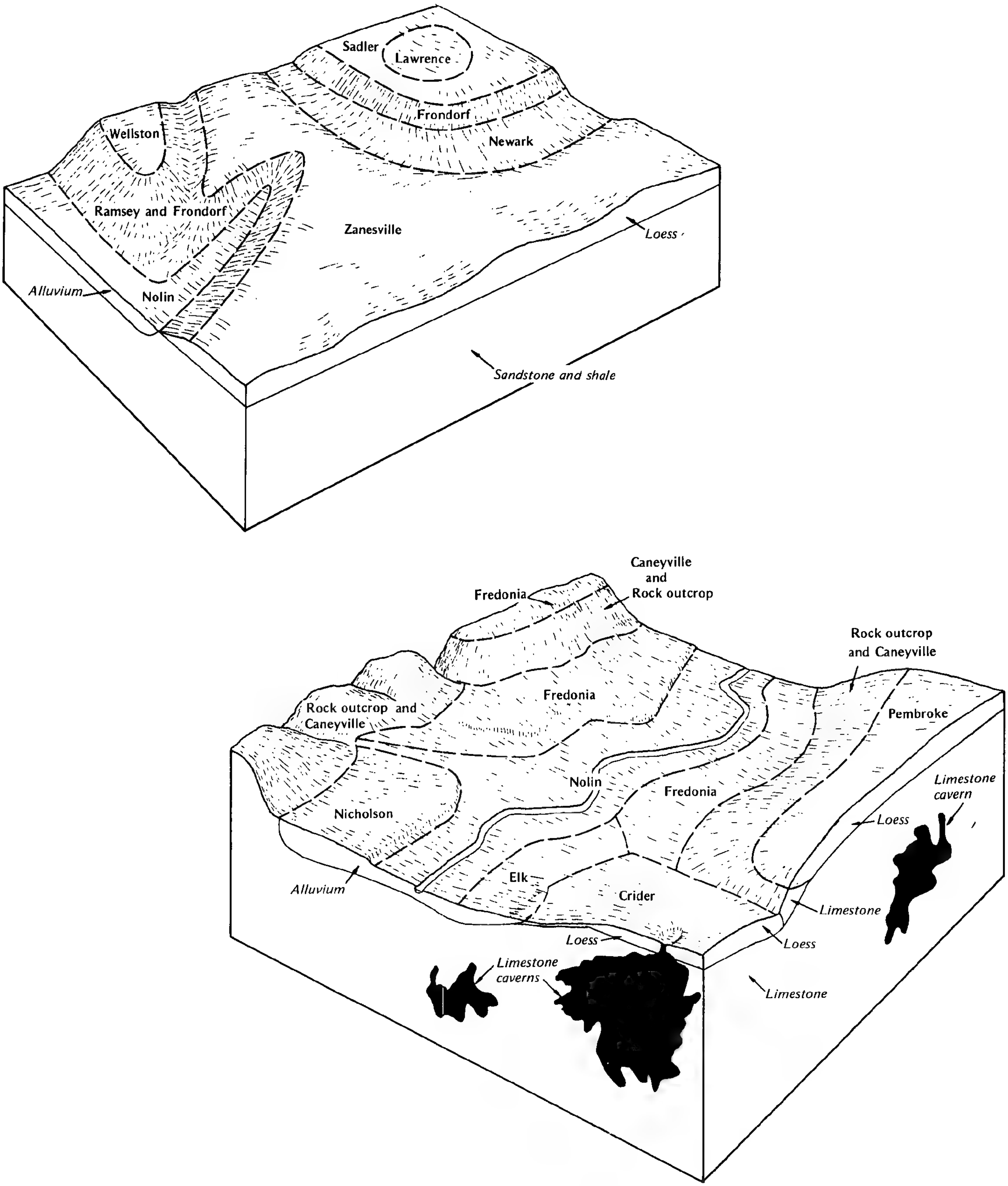
This map unit occupies 29 percent of the county. It is about 27 percent Fredonia soils, 23 percent Caneyville soils, and 50 percent soils of minor extent and Rock outcrop.

Fredonia soils are gently sloping to sloping, well drained soils on uplands, mostly at elevations above and below the Caneyville soils. They have a surface layer of reddish brown silt loam and a moderately permeable to slowly permeable, dominantly clayey subsoil.

Caneyville soils are gently sloping to very steep, well drained soils on uplands between areas of Fredonia soils. They have a surface layer of brown silt loam or reddish brown silty clay, and they have a moderately slowly permeable, dominantly clayey subsoil.

Of minor extent in this map unit are the Pembroke, Crider, Frondorf, Nolin, Lindside, Newark, Elk, and Nicholson soils. The well drained Pembroke, Crider, and Frondorf soils are on uplands. The well drained Nolin soils, the moderately well drained Lindside soils, and the somewhat poorly drained Newark soils are on the river bottoms and along narrow drainageways. The well drained Elk soils and the moderately well drained Nicholson soils are on stream terraces. Also of minor extent is Rock outcrop mapped in complex with the Caneyville soils.

On most of the acreage, the soils are used for pasture, hay, a few cultivated crops, and woodland. The less sloping soils are suited to those uses. The main limitations to the use of the soil for farming are the moderate depth to bedrock and the erosion hazard.



Typical pattern of soils and underlying material in the Zanesville-Sadler map unit (figure 3, top) and the Fredonia-Caneyville map unit (figure 4, bottom).

The soils in this map unit are poorly suited to urban uses. Steepness of slope, the moderate depth to bedrock, and shrink-swell potential are the main limitations to those uses.

The soils in this map unit are suited to woodland use. The main concerns of management are the erosion hazard, limitations to the use of equipment, seedling mortality, and plant competition.

The soils in this map unit are suited to some intensive recreation uses. Steepness of slope, the moderate depth to bedrock, and slow permeability are the main limitations to those uses.

The soils in this map unit have good potential for use as openland and woodland wildlife habitat.

5. Pembroke-Crider

Deep, nearly level to sloping, well drained soils that have a loamy and clayey subsoil; formed in loess and the residuum of limestone on uplands

This map unit consists mostly of broad flats, gently rolling areas, and knobs dissected by rivers, small streams, and drainageways. Some areas are karst and drain through depressions or sinks (fig. 5).

This map unit makes up about 21 percent of the county. It is about 82 percent Pembroke soils, 15 percent Crider soils, and 3 percent soils of minor extent.

Pembroke soils are nearly level to sloping, well drained soils on broad plains and knobs. They have a surface layer of dark brown silt loam. The upper part of the subsoil is loamy material, and the lower part is clayey material. Permeability is moderate.

Crider soils are gently sloping to sloping, well drained soils on uplands. They have a surface layer of brown silt loam. The subsoil is moderately permeable and loamy in the upper part and is clayey in the lower part.

Of minor extent in this map unit are the well drained Baxter and Fredonia soils on uplands, the well drained Nolin soils and the somewhat poorly drained Newark soils on bottom lands, and the moderately well drained Nicholson soils and the well drained Elk soils on the stream terraces.

On most of the acreage, the soils are used for cultivated crops, hay, pasture, and some specialty crops and woodland. They are well suited to hay, pasture, and all cultivated crops, and to some specialty crops grown in the county. Steepness of slope and the erosion hazard are the main limitations to farming.

The soils in this map unit are suited to most urban uses. Steepness of slope, clayey texture of the subsoil, and shrink-swell potential are the main limitations to urban uses.

The soils in this map unit are well suited to woodland use. The main concern of management is plant competition.

The soils in this map unit are well suited to intensive recreation uses. Steepness of slope is the main limitation to those uses.

The soils in this map unit have good potential for use as openland and woodland wildlife habitat.

6. Hammack-Baxter

Deep, gently sloping to sloping, well drained soils that have a loamy and clayey subsoil; formed in loess and the residuum of cherty limestone on uplands

This map unit consists of one small area in the northeastern part of the county (fig. 6). The landscape is made up of broad, undulating to rolling uplands. The area is karst and drains through depressions and sinks.

This map unit makes up about 2 percent of the county. It is about 65 percent Hammack soils, 10 percent Baxter soils, and 25 percent soils of minor extent.

The well drained, gently sloping Hammack soils are on uplands. They have a surface layer of dark yellowish brown silt loam. The subsoil is loamy material in the upper part and is cherty and clayey material in the lower part. Permeability is moderate.

The well drained, gently sloping to sloping Baxter soils are on uplands. They have a surface layer of brown cherty silt loam and a dominantly cherty and clayey subsoil. Permeability is moderate.

Of minor extent in this map unit are the deep, well drained Pembroke and Crider soils and the moderately deep, well drained Fredonia soils on the uplands and the well drained Nolin soils in the depressions.

On most of the acreage, the soils are used for cultivated crops, specialty crops, hay, and pasture. They are suited to most of the crops grown in the county. Steepness of slope and the erosion hazard are the main limitations to use of the soils for crops.

The soils in this map unit are suited to urban uses. Steepness of slope, clayey texture of the subsoil, and shrink-swell potential are the main limitations to those uses.

The soils in this map unit are well suited to woodland use. Plant competition is the main concern of management.

The soils in this map unit are suited to intensive recreation uses. The main limitations are steepness of slope and small stones.

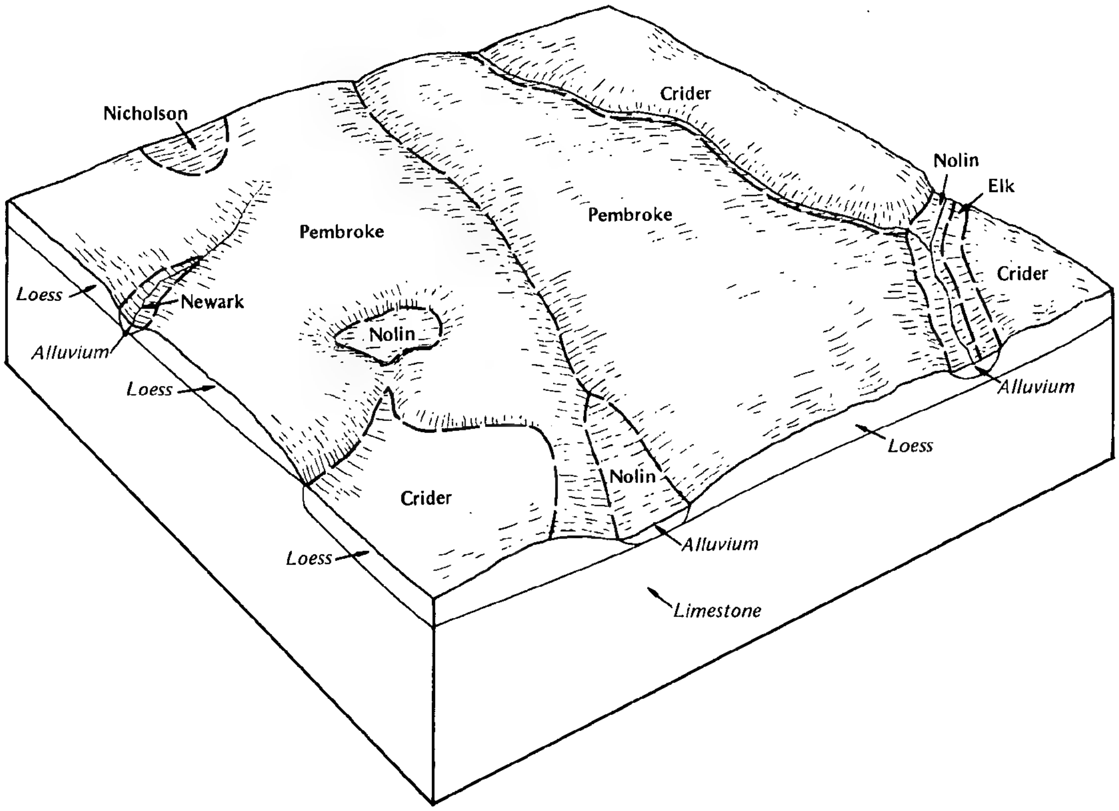
The soils in this map unit have good potential for use as openland and woodland wildlife habitat.

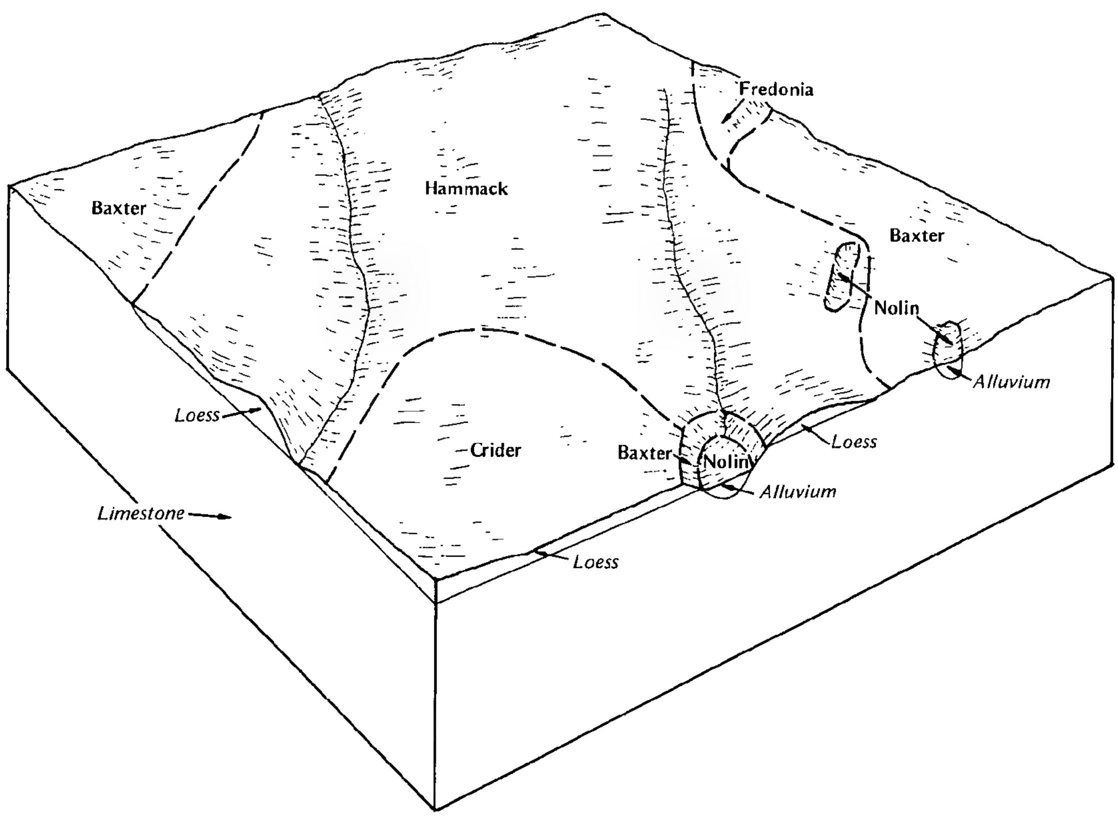
7. Baxter-Nicholson

Deep, nearly level to steep, well drained and moderately well drained soils that have a clayey subsoil or a loamy subsoil that includes a fragipan; formed in loess and in the residuum of cherty limestone on uplands

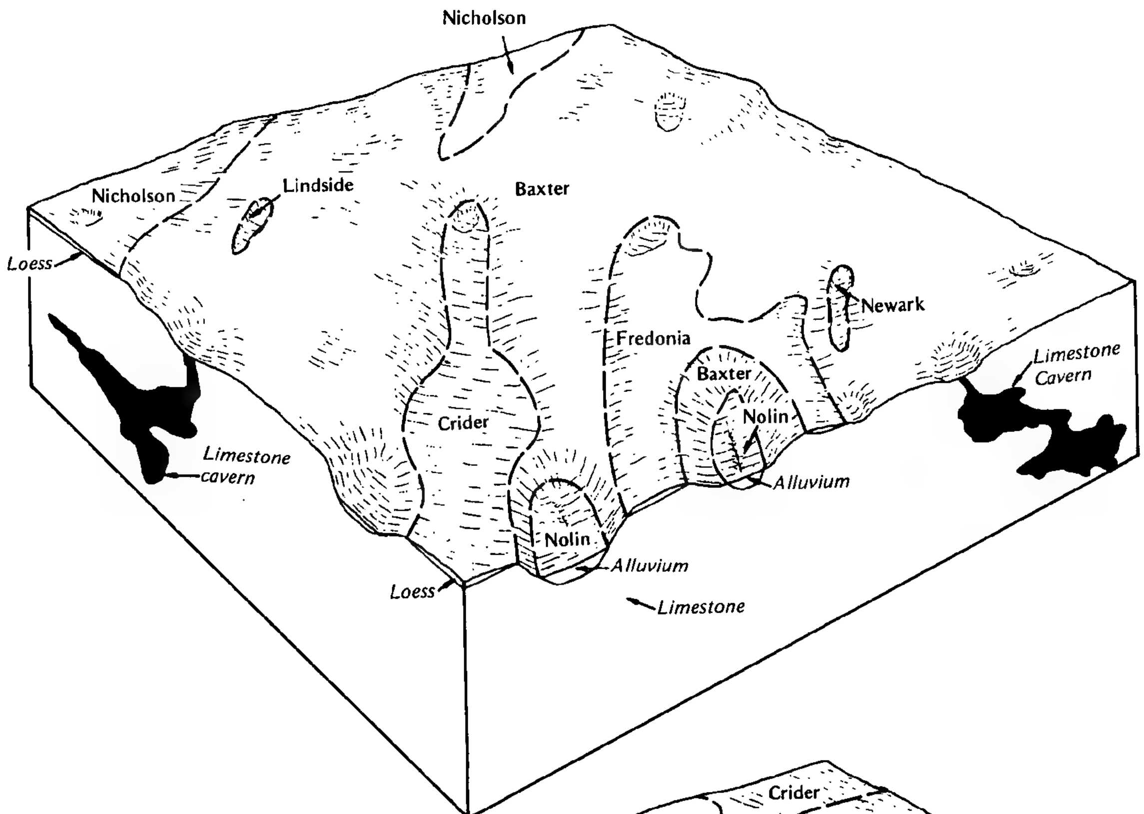
This map unit is in the eastern part of the county. It consists of broad, undulating plains, hills, valleys, sinks, and ridges dissected by rivers, small streams, and drainageways (fig. 7).

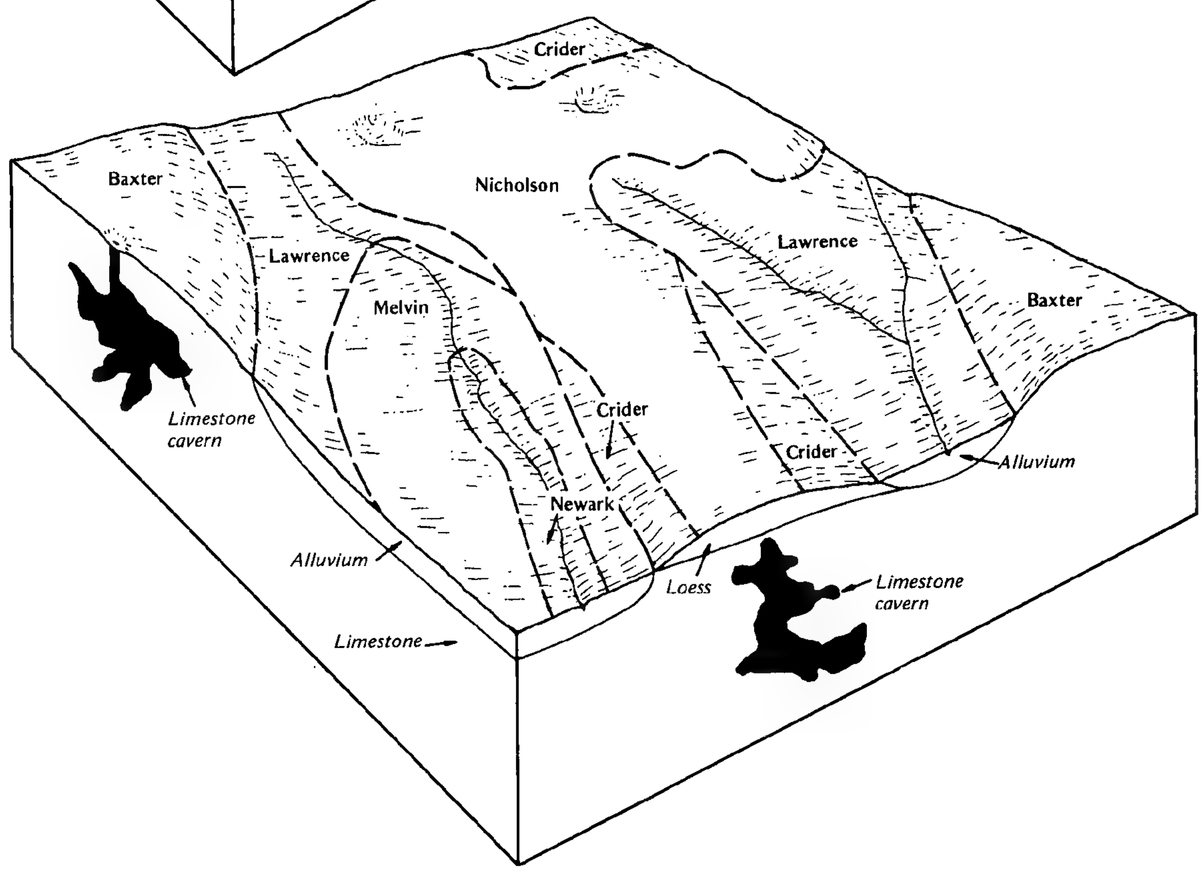
This map unit makes up about 29 percent of the county. It is about 75 percent Baxter soils, 8 percent Nicholson soils, and 17 percent soils of minor extent.





Typical pattern of soils and underlying material in the Pembroke-Crider map unit (figure 5, top) and the Hammack-Baxter map unit (figure 6, bottom).





Typical pattern of soils and underlying material in the Baxter-Nicholson map unit (figure 7, top) and the Lawrence-Nicholson map unit (figure 8, bottom).

Baxter soils are well drained. They generally are in karst areas and on ridges and hillsides. The slope range is 2 to 30 percent. The surface layer is brown cherty silt loam. The subsoil is dominantly cherty and clayey material. Permeability is moderate.

Nicholson soils are moderately well drained and are nearly level to gently sloping. They have a surface layer of dark grayish brown silt loam. The upper part of the subsoil is loamy. The lower part consists of a slowly permeable, firm, compact loamy fragipan between depths of 25 and 37 inches and, below that, clayey material.

Of minor extent in this map unit are the well drained Pembroke, Crider, Fredonia, and Caneyville soils on uplands. Also of minor extent are the poorly drained Melvin soils, the well drained Nolin soils, the moderately well drained Lindside soils, and the somewhat poorly drained Newark soils. These soils are on narrow flood plains and in upland depressions.

On most of the acreage, the soils are used for cultivated crops, hay, pasture, and woodland. The nearly level and sloping soils are suited to many of the cultivated crops grown in the county. The severely eroded soils and the moderately steep to steep soils are poorly suited to cultivated crops. The main limitations to the use of the soils for crops are the steepness of slope, the erosion hazard, the fragipan, and the moderately deep root zone.

The nearly level to sloping soils are suited to urban development. The moderately steep to steep soils are poorly suited to urban development. The steepness of slope, clayey texture of the subsoil, and shrink-swell potential are the main limitations. The use of the soils for local roads and streets is limited by the low strength of the soil material.

The soils in this map unit are well suited to woodland use. The main concerns of management are the erosion hazard, plant competition, and limitations to the use of equipment.

The soils in this map unit are suited to intensive recreation uses. Steepness of slope, wetness, slow permeability, and the small stones on the surface are the main limitations to those uses.

The soils in this map unit have good potential for use as openland and woodland wildlife habitat.

8. Lawrence-Nicholson

Deep, nearly level to gently sloping, somewhat poorly drained to moderately well drained soils that have a loamy subsoil that includes a fragipan; formed in alluvium or in loess and the residuum of limestone on uplands

This map unit consists of one small area in the southeastern part of the county. It is a broad, nearly level, flat plain drained by small streams and drainageways that terminate in sinks (fig. 8).

This map unit makes up 2 percent of the county. It is about 30 percent Lawrence soils, 15 percent Nicholson soils, and 55 percent soils of minor extent.

Lawrence soils are somewhat poorly drained and are nearly level. They are on depressional uplands. These soils have a surface layer of grayish brown silt loam. The subsoil is dominantly loamy and has a firm, compact, slowly permeable fragipan at a depth of 18 to 25 inches.

Nicholson soils are moderately well drained and are nearly level to gently sloping. They have a surface layer of dark grayish brown silt loam. The upper part of the subsoil is loamy. The lower part consists of a slowly permeable loamy fragipan at a depth of 24 to 30 inches and, below that, clayey material.

Of minor extent in this map unit are the well drained Crider and Baxter soils at the higher elevations and the somewhat poorly drained Newark soils and the poorly drained Robertsville and Melvin soils along the streams and in depressional areas.

On most of the acreage, the soils are used for hay and pasture. They are suited to a few of the cultivated crops grown in the county. The slow permeability, the moderately deep root zone, and the high water table are the main limitations to those uses.

The soils in this map unit are poorly suited to urban uses. Wetness and flooding are the main limitations to those uses. The low strength of the soil material is the main limitation to use of the soils for local roads and streets.

The soils in this map unit are suited to woodland use. The main concerns of management are limitations to the use of equipment and plant competition.

The soils in this map unit are poorly suited to intensive recreation uses. The main limitations are flooding, wetness, and slow permeability.

The soils in this map unit have good potential for use as openland and woodland wildlife habitat.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Pembroke silt loam, 2 to 6 percent slopes, is one of several phases in the Pembroke series.

Some map units are made up of two or more major soils. These map units are called *soil complexes*. A complex consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Ramsey-Frondorf complex, 20 to 40 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary to tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

BaB—Baxter cherty silt loam, 2 to 6 percent slopes. This soil is deep, well drained, and gently sloping. It is on broad, undulating plateaus and ridgetops of the limestone upland. The slopes are smooth and irregular. Areas are 5 to 30 acres.

Typically, the surface layer is brown cherty silt loam about 8 inches thick. The subsoil extends to a depth of 88 inches or more. It is yellowish red cherty silty clay loam in the upper part and is red cherty clay in the lower part.

This soil is medium in natural fertility and is moderate in organic matter content. It is strongly acid to very strongly acid throughout, except where the surface layer has been limed. Permeability is moderate, and the available water capacity is high. The soil has good tilth, except in areas where chert fragments are abundant. It can be worked throughout a wide range of moisture content. The root zone is deep and is easily penetrated by the roots. The shrink-swell potential is moderate.

Included in mapping are a few small areas of Crider, Pembroke, and Nicholson soils and small areas of soils that are chert free in the upper 24 to 30 inches. Also included are a few small, eroded areas.

On most of the acreage, the soil is used for cultivated crops. In a few areas, it is used as pasture and woodland.

This soil is suited to row crops, small grain, hay, and pasture. If it is well managed, high yields can be obtained. Good tilth is easily maintained by returning crop residue to the soil. If the soil is cultivated, erosion is a moderate hazard. Minimum tillage, no-tillage, and use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is well suited to eastern white pine, yellow-poplar, black locust, shortleaf pine, and loblolly pine. Plant competition is the main concern in woodland management.

This soil is suited to most urban uses. The gentle slope, clayey subsoil material, and moderate shrink-swell potential are the main limitations. These limitations can be overcome by good design and careful installation procedures. The low strength of the soil material is a limitation to the use of the soil for roads and streets.

This soil is suited to intensive recreation uses. The only limitation is the high content of chert in the surface layer.

This soil has good potential for use as habitat for woodland wildlife and openland wildlife.

This map unit is in capability subclass IIe and woodland suitability group 2o.

BaC—Baxter cherty silt loam, 6 to 12 percent slopes. This soil is deep, well drained, and sloping. It is on ridgetops and side slopes of the limestone upland. The slopes are smooth and irregular. Areas are 5 to 30 acres.

Typically, the surface layer is brown cherty silt loam about 8 inches thick. The subsoil, to a depth of 88 inches or more, is yellowish red cherty silty clay loam in the upper part and is red cherty clay in the lower part.

This soil is medium in natural fertility and is moderate in organic matter content. It is strongly acid to very strongly acid throughout, except where the surface layer has been limed. Permeability is moderate, and the available water capacity is high. The soil has fair tilth and can be worked throughout a wide range of moisture content. The root zone is deep and is easily penetrated by the roots. The shrink-swell potential is moderate.

Included in mapping are a few small areas of Crider, Pembroke, and Nicholson soils and small areas of soils that are chert free in the upper 24 to 30 inches. Also included are a few small, eroded areas.

On most of the acreage, the soil is used for pasture and cultivated crops (fig. 9). In a few areas, it is used as woodland.

This soil is suited to cultivated crops, small grain, hay, and pasture. Good tilth is easily maintained by returning crop residue to the soil. If the soil is cultivated, erosion is a severe hazard. Minimum tillage, no-tillage, and use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is well suited to eastern white pine, yellow-poplar, black locust, shortleaf pine, and loblolly pine. Plant competition is a severe limitation to woodland use.

This soil is suited to most urban uses. The moderate shrink-swell potential, clayey subsoil material, and steepness of slope are limitations to those uses. These limitations can be overcome by good design and careful installation procedures. The low strength of the soil material is a limitation to the use of this soil for local roads and streets.

This soil is suited to intensive recreation uses. Steepness of slope and the small stones in the surface layer are the main limitations to those uses.

This soil has good potential for use as habitat for woodland wildlife and openland wildlife.

This map unit is in capability subclass IIIe and woodland suitability group 2o.

BaD—Baxter cherty silt loam, 12 to 20 percent slopes. This soil is deep, well drained, and moderately steep. It is on ridgetops and side slopes of limestone upland. The slopes are smooth and irregular. Areas are 5 to 50 acres.

Typically, the surface layer is brown cherty silt loam about 8 inches thick. The subsoil, to a depth of 88 inches or more, is yellowish red cherty silty clay loam in the upper part and is red cherty clay in the lower part.

This soil is medium in natural fertility, and it is moderate in organic matter content. It is strongly acid to very strongly acid throughout, except where the surface layer has been limed. Permeability is moderate, and the available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and is easily penetrated by the roots. The shrink-swell potential is moderate.

Included in mapping are a few small areas of Caneyville soils and Rock outcrop. Also included are a few eroded and gullied areas.

On most of the acreage, the soil is used as woodland and pasture. In a few areas, it is used for cultivated crops.

This soil is poorly suited to cultivated crops and small grain. It is suited to pasture and hay. Good tilth is maintained by returning crop residue to the soil. If the soil is cultivated, erosion is a very severe hazard. Minimum tillage, no-tillage, and use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is well suited to eastern white pine, yellow-poplar, shortleaf pine, black locust, and loblolly pine. The erosion hazard, limitations to the use of equipment, and plant competition are concerns in woodland management.

This soil is poorly suited to urban uses. Steepness of slope is the main limitation to those uses.

This soil is poorly suited to intensive recreation uses. Steepness of slope and small stones are limitations to those uses.

This soil has good potential for use as habitat for woodland wildlife, and it has fair potential for use as habitat for openland wildlife.

This map unit is in capability subclass IVe and woodland suitability group 2r.

BaE—Baxter cherty silt loam, 20 to 30 percent slopes. This soil is deep, well drained, and steep. It is on side slopes of the limestone upland. The slopes are rough and irregular. Areas are 5 to 50 acres.

Figure 9.—This area of Baxter cherty silt loam, 6 to 12 percent slopes, consists of fescue pasture in the foreground and corn in the background.

Typically, the surface layer is brown cherty silt loam about 8 inches thick. The subsoil, to a depth of 88 inches or more, is yellowish red cherty silty clay loam in the upper part and is red cherty clay in the lower part.

This soil is medium in natural fertility and is moderate in organic matter content. It is strongly acid to very strongly acid. Permeability is moderate, and the available water capacity is high. The root zone is deep and is easily penetrated by the roots. The shrink-swell potential is moderate.

Included in mapping are a few small areas of Caneyville soils, Rock outcrop, and some gullied and eroded areas.

On most of the acreage, the soil is used as woodland and some pasture. In a few areas, it is cultivated.

This soil is poorly suited to cultivated crops. Suitability is limited because of the steep slope. Erosion is a very severe hazard if the soil is not protected by vegetative cover.

This soil is well suited to yellow-poplar, black locust, shortleaf pine, eastern white pine, and loblolly pine. The erosion hazard, equipment limitations, and plant competition are concerns in woodland management.

This soil is poorly suited to urban development. Steepness of slope is the main limitation, and it is difficult to overcome. The low strength of the soil material is a limitation to the use of this soil for local roads and streets.

This soil is poorly suited to intensive recreation uses. Steepness of slope and the small stones in the surface layer are limitations to those uses.

This soil has fair potential for use as habitat for openland wildlife, and it has good potential for use as habitat for woodland wildlife.

This map unit is in capability subclass VIe and woodland suitability group 2r.

BbC3—Baxter cherty silty clay loam, 6 to 12 percent slopes, severely eroded. This soil is deep, well drained, and sloping. It is on ridgetops and side slopes of the limestone upland. Because of erosion, the original subsoil material is exposed in most places. Shallow gullies are common. The slopes are smooth and irregular. Areas are 5 to 50 acres.

Typically, the surface layer is yellowish red cherty silty clay loam about 3 inches thick. The subsoil extends to a depth of 88 inches or more. It is yellowish red cherty silty clay loam to a depth of 13 inches and red cherty clay below that depth.

This soil is low in natural fertility and organic matter content. It is strongly acid to very strongly acid throughout, except where the surface layer has been limed. Permeability is moderate, and the available water capacity is moderate. The soil has poor tilth because of the high content of clay in the surface layer. The root zone is deep and can be penetrated by the roots. The shrink-swell potential is moderate.

Included in mapping are a few small areas of Crider, Pembroke, and Nicholson soils. Also included are small areas of limestone outcrop and of soils that are chert free in the upper 24 to 30 inches.

On most of the acreage, the soil is used for pasture, and on the rest of the acreage it is used for cultivated crops and woodland.

This soil is poorly suited to cultivated crops and small grain because of the effects of past erosion, the very severe erosion hazard, the moderate available water capacity, and slope. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is suited to shortleaf pine, eastern redcedar, and loblolly pine. There are no significant limitations to woodland use.

This soil is suited to urban uses. The moderate shrink-swell potential, high clay content of the subsoil, and steepness of slope are limitations. These limitations can be overcome by good design and careful installation procedures. The low strength of the soil material is a limitation to the use of this soil for local roads and streets.

This soil is suited to intensive recreation uses. The small stones in the surface layer and steepness of slope limit those uses.

This soil has good potential for use as habitat for woodland wildlife and openland wildlife.

This map unit is in capability subclass IVe and woodland suitability group 3o.

BbD3—Baxter cherty silty clay loam, 12 to 20 percent slopes, severely eroded. This soil is deep, well drained, and moderately steep. It is on ridgetops and side slopes of the limestone upland. Because of erosion, the original subsoil material is exposed in most places, and shallow gullies are common. The slopes are smooth and irregular. Areas are 5 to 50 acres.

Typically, the surface layer is yellowish red cherty silty clay loam about 3 inches thick. The subsoil extends to a depth of 88 inches or more. It is red cherty silty clay loam, about 10 inches thick, in the upper part and is red cherty clay in the lower part.

This soil is low in natural fertility and organic matter content. It is strongly to very strongly acid throughout, except where the surface layer has been limed. Permeability is moderate, and the available water capacity is moderate. The soil has poor tilth because of the high content of clay in the surface layer. The shrink-swell potential is moderate.

Included in mapping are a few small areas of Caneyville soils and Rock outcrop and some gullied areas.

On most of the acreage, the soil is used as woodland and pasture. It is poorly suited to cultivated crops and small grain. The suitability is limited by the very severe erosion hazard, the moderate available water capacity, and the moderately steep slope. If the soil is cultivated, erosion is a very severe hazard.

This soil is suited to woodland use. The trees suited are eastern redcedar, shortleaf pine, and loblolly pine. The limitations to the use of equipment, plant competition, and the erosion hazard are the main concerns in management.

This soil is poorly suited to urban uses. Steepness of slope and clayey subsoil material are the main limitations to those uses. These limitations can be overcome by using good design and careful installation procedures. The low strength of the soil material is a limitation to the use of this soil for local roads and streets.

This soil is poorly suited to intensive recreation uses. The main limitations are steepness of slope and small stones in the surface layer.

The potential is fair for openland wildlife habitat, and it is good for woodland wildlife habitat.

This map unit is in capability subclass VIe and woodland suitability group 3r.

CaB—Caneyville silt loam, 2 to 6 percent slopes. This soil is moderately deep, well drained, and gently sloping. It is on ridgetops of the limestone upland. The slopes are smooth and complex. Areas are 5 to 30 acres.

Typically, the surface layer is brown silt loam about 6 inches thick. The upper part of the subsoil is reddish brown silty clay, and the lower part is yellowish red to dark reddish brown clay. Limestone bedrock is at a depth of 27 inches.

This soil is medium in natural fertility and is moderate in organic matter content. It is strongly acid to medium acid in the upper part and is medium acid to neutral in the lower part. Permeability is moderately slow, and the

available water capacity is moderate. The root zone is moderately deep. The depth to bedrock is 20 to 40 inches. The shrink-swell potential is moderate.

Included in mapping are a few eroded and gullied areas. Also included are a few small areas of Crider and Pembroke soils.

On most of the acreage, the soil is used for crops and pasture. This soil is suited to row crops and small grain, and it is well suited to hay and pasture. The suitability is limited because the available water capacity is moderate. Good tilth can be maintained by returning crop residue to the soil. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is suited to eastern redcedar, Virginia pine, shortleaf pine, eastern white pine, and loblolly pine. The concerns in management are moderate equipment limitations, plant competition, and seedling mortality.

This soil is poorly suited to most urban uses. The moderate depth to bedrock, shrink-swell potential, and steepness of slope are the main limitations to those uses. Some of the limitations can be overcome by using good design and careful installation procedures. The low strength of the soil material is a limitation to the use of this soil for local roads and streets.

This soil is suited to intensive recreation uses. The slow permeability, slope, and moderate depth to bedrock are limitations to those uses.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IIIe and woodland suitability group 3c.

CaC—Caneyville silt loam, 6 to 12 percent slopes. This soil is moderately deep, well drained, and sloping. It is on ridgetops and side slopes of the limestone upland. The slopes are smooth and irregular. Areas are 5 to 30 acres.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil to a depth of 27 inches is reddish brown silty clay in the upper part and is yellowish red to dark reddish brown clay in the lower part. Below that depth is limestone bedrock.

This soil is medium in natural fertility and is moderate in organic matter content. It is strongly acid to medium acid in the upper part and is medium acid to neutral in the lower part. Permeability is moderately slow, and the available water capacity is moderate. The root zone is moderately deep. Bedrock is at a depth of 20 to 40 inches. The shrink-swell potential is moderate.

Included in mapping are a few eroded and gullied areas and small areas of Crider and Pembroke soils.

On most of the acreage, the soil is used for pasture and woodland. In a few areas, it is used for cultivated crops.

This soil is poorly suited to cultivated crops and small grain. It is suited to hay and pasture. Suitability is limited because the areas are small and the available water capacity is moderate.

This soil is suited to eastern redcedar, eastern white pine, loblolly pine, shortleaf pine, and Virginia pine. The main concerns in woodland management are limitations to the use of equipment, plant competition, and seedling mortality.

This soil is poorly suited to urban uses. The depth to bedrock, shrink-swell potential, and slope are the main limitations to those uses. Some of the limitations can be overcome by using good design and careful installation procedures. The low strength of the soil material is a limitation to the use of this soil for local roads and streets.

This soil is suited to most intensive recreation uses. Steepness of slope and slow permeability are the main limitations to those uses.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IVe and woodland suitability group 3c.

CnC3—Caneyville silty clay, 6 to 12 percent slopes, severely eroded. This soil is moderately deep, well drained, and sloping. It is on ridgetops and side slopes on limestone uplands. Because of erosion, the clayey subsoil material is exposed, and shallow gullies are common. The slopes are smooth and irregular. Areas are 5 to 30 acres.

Typically, the surface layer is reddish brown silty clay about 3 inches thick. The upper part of the subsoil is yellowish red silty clay, and the lower part is yellowish red and dark reddish brown clay. Limestone bedrock is at a depth of about 22 inches.

This soil is low in natural fertility and organic matter content. It is strongly acid to medium acid in the upper part and is medium acid to neutral in the lower part. Permeability is moderately slow, and the available water capacity is low. The root zone is moderately deep. Bedrock is at depths of 20 to 40 inches. The shrink-swell potential is moderate.

Included in mapping are a few gullied areas and limestone outcrop and a few small areas of Crider and Pembroke soils.

On most of the acreage, the soil is used for pasture and woodland. In a few areas, it is used for cultivated crops.

This soil is not suited to cultivated crops and small grain, but it is suited to pasture and hay. The suitability is limited because the areas are small and the available water capacity is low.

This soil is suited to eastern redcedar, Virginia pine, and loblolly pine. The erosion hazard, equipment limitations, and seedling mortality are concerns in management.

This soil is poorly suited to most urban uses. The moderate depth to bedrock, shrink-swell potential, and slope are the main limitations to those uses. Some of the limitations can be overcome by using good design and careful installation procedures. The low strength of

the soil material is a limitation to the use of this soil for local roads and streets.

This soil is poorly suited to intensive recreation uses. Steepness of slope and high clay content of the subsoil are limitations to those uses.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass VIe and woodland suitability group 4c.

CoD—Caneyville-Rock outcrop complex, 6 to 20 percent slopes. This complex consists of small areas of Caneyville soil and Rock outcrop. The Caneyville soil is sloping to moderately steep, well drained, moderately deep, and clayey. It occurs as narrow strips 50 to 100 feet wide separated by strips of rock outcrops and rock ledges along the side slopes. Areas are about 25 to 100 acres.

Caneyville silt loam makes up about 65 percent of each mapped area. Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil to a depth of 27 inches is reddish brown silty clay in the upper part and is yellowish red clay grading to dark reddish brown clay in the lower part. Limestone bedrock is at a depth of 27 inches.

The Caneyville soil is medium in natural fertility and is moderate in organic matter content. Reaction is strongly acid to medium acid in the upper part and medium acid to neutral in the lower part. Permeability is moderately slow, and available water capacity is moderate. The root zone is moderately deep. Bedrock is at a depth of 20 to 40 inches. The shrink-swell potential is moderate.

Outcrops of limestone make up about 20 percent of each mapped area. In some areas, dark gray to black silty clay up to 3 inches thick covers the limestone. Areas are 2 to 100 square feet. The Rock outcrop is in the form of ledges, boulders, and cliffs.

Included in mapping are small areas of Fredonia soils and soils that have a thin surface layer of dark grayish brown silt loam and a subsoil of light yellowish brown to olive yellow clay.

On most of the acreage, the Caneyville soil is used as pasture and some woodland (fig. 10). It is not suited to cultivated crops and hay. It is suited to pasture, but the pasture is difficult to manage because of the outcrops and ledges of rock.

The Caneyville soil is suited to eastern redcedar, Virginia pine, eastern white pine, and loblolly pine. The erosion hazard, plant competition, equipment limitations, and seedling mortality are concerns in management.

The Caneyville soil is poorly suited to urban uses. The moderate depth to bedrock, shrink-swell potential, and steepness of slope are the main limitations to those uses. These limitations are difficult to overcome. The low strength of the soil material is a limitation to the use of this soil for local roads and streets.

The Caneyville soil is poorly suited to most intensive recreation uses. Steepness of slope, slow permeability, and the hazard of erosion are the main limitations to those uses.

The Caneyville soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This complex is in capability subclass VIs and woodland suitability group 3x.

CoE—Caneyville-Rock outcrop complex, 20 to 35 percent slopes. This complex consists of small areas of Caneyville soil and Rock outcrop. The Caneyville soil is steep to very steep, moderately deep, well drained, and clayey. It occurs as narrow strips 50 to 100 feet wide separated by strips of rock outcrops, ledges, and boulders along the side slopes.

Caneyville silt loam makes up about 65 percent of each mapped area. Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil to a depth of 27 inches is reddish brown silty clay in the upper part and is yellowish red and dark reddish brown clay in the lower part. Limestone bedrock is at a depth of 27 inches.

The Caneyville soil is medium in natural fertility and moderate in organic matter content. Reaction is strongly acid to medium acid in the upper part and is medium acid to neutral in the lower part. Permeability is moderately slow, and the available water capacity is moderate. The root zone is moderately deep. Bedrock is at a depth of 20 to 40 inches. The shrink-swell potential is moderate.

Rock outcrop makes up about 20 percent of each mapped area. In some places, dark gray to black silty clay up to 3 inches thick covers the limestone. The areas are 2 to 100 square feet. The Rock outcrop makes up ledges and cliffs. In some areas irregular boulders 1 to 10 feet in diameter are exposed near the Rock outcrops, rock ledges, and cliffs.

Included in mapping are small areas of Fredonia soils and other soils that have a thin surface layer of dark grayish brown silt loam and a subsoil of light yellowish brown to olive yellow clay.

On most of the acreage, the Caneyville soil is used for pasture and woodland. This acreage is on the lower part of slopes where rock outcrops, and boulders are not so prominent. The soil is not suited to cultivated crops and hay. It is suited to limited use for pasture. Pasture is difficult to manage because of the steepness of slope and the rock outcrops.

The Caneyville soil is suited to yellow-poplar, black walnut, and Virginia pine on north-facing slopes and eastern redcedar, Virginia pine, eastern white pine, shortleaf pine, and loblolly pine on south-facing slopes. The erosion hazard, plant competition, limitations to the use of equipment, and seedling mortality are concerns in woodland management.

The Caneyville soil is poorly suited to urban uses. The moderate depth to bedrock and steepness of slope are limitations to those uses and are difficult to overcome.

Figure 10.—Unimproved pasture on Caneyville-Rock outcrop complex, 6 to 20 percent slopes.

The low strength of the soil material is a limitation to the use of this soil for local roads and streets.

The Caneyville soil is poorly suited to intensive recreation uses. Steepness of slope, rock outcrops, and the erosion hazard are limitations to those uses.

The Caneyville soil has fair potential for use as openland wildlife habitat, and it has good potential for use as woodland wildlife habitat.

This complex is in capability subclass VIIs and in woodland suitability groups 2x (north aspect) and 3x (south aspect).

CrB—Crider silt loam, 2 to 6 percent slopes. This soil is deep, well drained, and gently sloping. It is on broad plateaus of the limestone upland. The slopes are smooth and convex. Areas are 5 to 50 acres.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil to a depth of 70 inches is strong brown and yellowish red silty clay loam in the upper part and is red silty clay loam that grades to dark red clay mottled with yellowish red and brown in the lower part.

This soil is high in natural fertility and is moderate in organic matter content. Reaction is neutral to strongly acid in the upper part and is medium acid to very strongly acid in the lower part. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and is easily penetrated by the roots. The shrink-swell potential is low in the upper part of the subsoil and is moderate in the lower part.

Included in mapping are a few small areas of Baxter, Pembroke, and Nicholson soils. Also included are small areas of the severely eroded Crider soils.

On most of the acreage, the soil is used for cultivated crops. In a few areas, it is used as woodland and pasture.

This soil is well suited to row crops, small grain, hay, and pasture. Good tilth is easily maintained by returning crop residue to the soil. If the soil is cultivated, erosion is a moderate hazard. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is well suited to yellow-poplar, eastern white pine, black walnut, white ash, and loblolly pine. Plant competition is the main limitation to woodland use.

This soil is well suited to urban uses. The main limitations are slope and the high clay content of the subsoil. These limitations can be easily overcome by good design and careful installation procedures. The low strength of the soil material is a limitation to use for local roads and streets.

This soil is well suited to intensive recreation uses. Slope is the main limitation to those uses.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IIe and woodland suitability group 1o.

CrC—Crider silt loam, 6 to 12 percent slopes. This soil is deep, well drained, and sloping. It is on limestone uplands. The slopes are smooth and convex. Areas are 5 to 50 acres.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil to a depth of 70 inches is strong brown and yellowish red silty clay loam in the upper part and is red silty clay loam that grades to dark red clay mottled with yellowish red and brown in the lower part.

This soil is medium in natural fertility and is moderate in organic matter content. Reaction is neutral to strongly acid in the upper part and is medium acid to very strongly acid in the lower part. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and is easily penetrated by the roots. The shrink-swell potential is low in the upper part of the subsoil and moderate in the lower part.

Included in mapping are a few small areas of Baxter, Pembroke, and Nicholson soils. Also included are small areas of severely eroded Crider soils.

On most of the acreage, the soil is used for cultivated crops. In a few areas, it is used as woodland and pasture.

This soil is suited to row crops and small grain. The suitability is limited because of the steepness of slope and small areas. Good tilth is easily maintained if crop residue is returned to the soil. If the soil is cultivated, erosion is a severe hazard. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is well suited to yellow-poplar, eastern white pine, black walnut, loblolly pine, and white ash. Plant competition is the main concern in woodland management.

This soil is suited to urban uses. Steepness of slope and the clayey subsoil material are the main limitations to those uses but can be overcome by good design and careful installation procedures. The low strength of the soil material is a limitation to the use of the soil for local roads and streets.

This soil is suited to intensive recreation uses. The main limitation is steepness of slope.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IIIe and woodland suitability group 1o.

Du—Dunning silty clay loam. This soil is very poorly drained to poorly drained, nearly level, and deep. It is on flood plains and in ponded areas. The slopes are 0 to 2 percent and are smooth and concave. Areas are 5 to 50 acres.

Typically, the surface layer, about 16 inches thick, is very dark grayish brown to very dark gray silty clay loam mottled with dark yellowish brown. The subsoil extends to a depth of 43 inches. It is dark gray silty clay mottled with dark yellowish brown in the upper part and dark gray clay mottled with brown in the lower part. The underlying material to a depth of 65 inches is dark gray clay.

This soil is high in natural fertility and organic matter content. It is slightly acid to mildly alkaline. Permeability is slow, and the available water capacity is high. The soil has fair tilth and can be worked within only a narrow range of moisture content. The root zone is deep, but is saturated periodically by a seasonal high water table within 6 inches of the surface. The shrink-swell potential is moderate. This soil is subject to frequent flooding.

Included in mapping are areas of moderately well drained soils that have a dark brown surface layer. Also included are a few areas of Lawrence and Melvin soils.

On most of the acreage, the soil is used as cropland. In a few small areas, it is used as woodland and pasture.

This soil is limited for cropland use because the areas are small and are subject to frequent flooding and long periods of water saturation. If drained, the soil is well suited to row crops. Good management affects the yield potential.

This soil is well suited to pin oak and loblolly pine. Plant competition, seedling mortality, and limitations to the use of equipment are concerns in woodland management.

This soil is poorly suited to urban uses and intensive recreation uses. Wetness and flooding are limitations to

those uses. The low strength of the soil material is a limitation to the use of the soil for local roads and streets.

This soil has poor potential for use as habitat for openland wildlife and woodland wildlife because of flooding and wetness, and it has good potential for use as habitat for wetland wildlife.

This map unit is in capability subclass IIIw and woodland suitability group 1w.

ElB—Elk silt loam, 2 to 6 percent slopes. This soil is deep, well drained, and gently sloping. It is on low stream terraces. The slopes are smooth. Areas are 5 to 25 acres.

Typically, the surface layer is brown silt loam about 10 inches thick. The subsoil is brown silt loam in the upper part and is brown to strong brown silty clay loam in the lower part. The substratum to a depth of 65 inches is yellowish brown mottled with light yellowish brown.

This soil is high in natural fertility and is moderate in organic matter content. It is medium acid to strongly acid throughout, except where the surface layer has been limed. Permeability is moderate, and the available water capacity is high. The root zone is deep and is easily penetrated by the roots. The shrink-swell potential is low. The Elk soil is occasionally flooded.

Included in mapping are a few small areas of Nolin, Crider, and Nicholson soils and areas of soils that are yellowish red in the lower part of the subsoil. The included soils make up less than 15 percent of this map unit. Some areas are underlain by residuum of limestone at depths of 40 to 60 inches.

On most of the acreage, the soil is used as cropland. In a few areas, it is used as pasture and woodland.

This soil is well suited to cultivated crops, small grain, hay, and pasture. Good tilth is easily maintained by returning crop residue to the soil. If the soil is cultivated, erosion is a moderate hazard. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is well suited to black walnut, yellow-poplar, loblolly pine, and eastern white pine. Plant competition is a concern in woodland management.

This soil is poorly suited to most urban uses. Occasional flooding is a limitation to those uses. The low strength of the soil material is a limitation to the use of the soil for local roads and streets.

This soil is suited to intensive recreation uses. It is limited by flooding for some uses.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IIe and woodland suitability group 2o.

FeC—Fredonia silt loam, very rocky, 2 to 12 percent slopes. This soil is moderately deep, well drained, and gently sloping to sloping. It is on limestone uplands. The slopes are smooth and irregular. Rock outcrops make up 2 to 10 percent of most areas.

Typically, the surface layer is reddish brown silt loam 5 inches thick. The subsoil is dark red silty clay in the upper part and dusty red clay in the lower part. Limestone bedrock is at a depth of 37 inches.

This soil is medium in natural fertility and is moderate in organic matter content. It is strongly acid to neutral. Permeability is moderately slow to slow, the available water capacity is moderate, and the shrink-swell potential is moderate. The root zone is moderately deep. Bedrock is at depths of 20 to 40 inches.

Included in mapping are a few areas of Pembroke, Crider, and Caneyville soils and small eroded areas, gullies, and areas where limestone ledges and rocks are exposed.

On most of the acreage, the soil is used for pasture. In a few areas, it is used for cultivated crops and woodland. This soil is not suited to cultivated crops because of the extent of rock outcrops and the erosion hazard.

This soil is suited to pasture and hay. Steepness of slope, the erosion hazard, the moderate depth to bedrock, and rock outcrops are the main limitations.

This soil is suited to eastern redcedar and Virginia pine. Plant competition and equipment limitations are concerns in woodland management.

This soil is poorly suited to urban uses. The depth to bedrock, slow permeability, steepness of slope, shrink-swell potential, and rock outcrops limit those uses. Some of the limitations can be overcome by good design and careful installation procedures. The low strength of the soil material is a limitation to the use of the soil for local roads and streets.

This soil is suited to intensive recreation uses. Steepness of slope and slow permeability are limitations to those uses.

This soil has good potential use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass VIe and woodland suitability group 3c.

FnC—Fredonia-Urban land complex, 2 to 12 percent slopes. This complex consists of the moderately deep, well drained, gently sloping to sloping Fredonia soil and areas of Urban land. This complex is on broad and rolling uplands. It commonly is irregular in shape and 15 to 200 acres in size.

Fredonia silt loam makes up about 70 percent of this complex. Typically, the surface layer is reddish brown silt loam about 6 inches thick. The subsoil, which extends to a depth of 37 inches, is dark red silty clay in the upper part and dusty red clay in the lower part. Bedrock is at a depth of 37 inches.

This Fredonia soil is medium in natural fertility. Permeability is moderately slow to slow, and the available water capacity is moderate. Reaction ranges from strongly acid to neutral. The organic matter content of the surface layer is moderate. The subsoil has

moderate shrink-swell potential. The root zone is moderately deep to bedrock at 20 to 40 inches.

Urban land makes up about 25 percent of this complex. Urban land consists mainly of dwellings, streets, sidewalks, small commercial buildings, schools, hospitals, parking lots, and playgrounds that so obscure or alter the soil that identification is not feasible.

Included in mapping are small areas of Baxter, Caneyville, and Pembroke soils and a few disturbed areas of Fredonia soils, where the surface layer is clayey and is very low in content of organic matter. Included soils make up about 5 percent of this map unit.

On most of the acreage, the Fredonia soil is used for lawns, playgrounds, parks, and schoolgrounds. In some places, it is in vacant lots that are covered mainly by grass, trees, or weeds.

The Fredonia soil is poorly suited to most urban uses. The moderate shrink-swell potential, slow permeability, steepness of slope, and depth to bedrock are limitations to those uses. Some of the limitations can be overcome by good planning and careful installation procedures. The low strength of the soil material is a limitation to the use of the soil for local roads and streets.

Most of the garden plants, flowers, trees, and shrubs commonly grown in the county grow well on this soil if management is good. Erosion is a moderate hazard if the vegetative cover is removed. In a few disturbed areas, this soil is difficult to work because the surface layer is clayey and low in organic matter content. In a few areas, bedrock is exposed.

This complex is not assigned to a capability class or woodland group.

FrC—Frondorf silt loam, 6 to 12 percent slopes. This soil is moderately deep, well drained, and sloping. It is on ridgetops and side slopes of the sandstone and shale uplands. Areas are 4 to 60 acres.

Typically, the surface layer is brown silt loam about 5 inches thick. The upper part of the subsoil is strong brown silty clay loam, grading to yellowish brown silty clay loam that has pale brown mottles. The lower part is yellowish brown channery silty clay loam that has light gray and yellowish brown mottles. Soft shale bedrock is at a depth of about 26 inches.

This soil is medium in natural fertility and is low in organic matter content. It is strongly acid to very strongly acid throughout, except where the surface has been limed. Permeability and the available water capacity are moderate. The root zone is moderately deep. The shrink-swell potential is low. Bedrock is at a depth of 20 to 40 inches.

Included in mapping are a few small areas of Wellston and Zanesville soils. Also included are a few areas of moderately deep clayey soils. In some areas slope is less than 6 percent, and in some, it is more than 12 percent. The included soils make up less than 15 percent of this map unit. Areas are 1 to 15 acres.

On most of the acreage, this soil is used for row crops, small grain, and, primarily, hay and pasture. The use of this soil for crops and pasture is limited because of the moderate depth to bedrock and the moderate available water capacity. If the soil is cultivated, erosion is a severe hazard. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system help to reduce runoff and control erosion.

This soil is well suited to black walnut, yellow-poplar, loblolly pine, shortleaf pine, and eastern white pine. Plant competition is a concern in woodland management.

This soil is suited to urban uses. It is limited mainly by steepness of slope and depth to bedrock. Some of the limitations can be overcome by good design and careful installation procedures.

This soil is suited to intensive recreation uses. Steepness of slope is the main limitation to those uses.

This soil has good potential for use as habitat for openland and woodland wildlife.

This map unit is in capability subclass IIIe and woodland suitability group 2o.

FrD—Frondorf silt loam, 12 to 20 percent slopes. This soil is moderately deep, well drained, and moderately steep. It is on side slopes of the sandstone and shale uplands. Areas are 5 to 175 acres.

Typically, the surface layer is brown silt loam about 5 inches thick. The upper part of the subsoil is strong brown silty clay loam grading to yellowish brown silty clay loam that has pale brown mottles. The lower part is yellowish brown channery silty clay loam that has light gray and yellowish brown mottles. Soft shale bedrock is at a depth of about 26 inches.

This soil is medium in natural fertility and is low in organic matter content. It is strongly acid to very strongly acid throughout, except where the surface has been limed. Permeability and the available water capacity are moderate. The root zone is moderately deep. The shrink-swell potential is low. Bedrock is at a depth of 20 to 40 inches.

Included in mapping are a few small areas of Wellston and Ramsey soils. Also included, in the north-central and northwestern parts of the county, are moderately deep and deep soils that have a yellowish red clay subsoil and deep, stratified sandy loams. In some areas slope is less than 12 percent, and in some, it is more than 20 percent. The included soils make up less than 15 percent of this map unit. Areas are 1 to 5 acres.

On most of the acreage, the soil is used as woodland. In a few areas, it is used for hay and pasture. This soil is limited because of the moderately steep slope, moderate depth, and moderate available water capacity. If row crops are grown, erosion is a severe hazard. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system help to reduce runoff and control erosion.

This soil is well suited to black walnut, yellow-poplar, loblolly pine, shortleaf pine, and eastern white pine. Plant competition is a concern in woodland management.

This soil is suited to urban uses. The main limitations are steepness of slope and the moderate depth to bedrock. Some of the limitations can be overcome by good design and careful installation procedures.

This soil is suited to intensive recreation uses. Steepness of slope is the main limitation to those uses.

This soil has good potential for use as habitat for openland and woodland wildlife.

This map unit is in capability subclass IVe and woodland suitability group 2o.

Gr—Grigsby sandy loam. This soil is deep, well drained, and nearly level. It is in alluvial areas, generally on bends along the flood plains of the Green and Barren Rivers. Areas are 12 to 100 acres. The slope range is 0 to 4 percent.

Typically, the surface layer is dark yellowish brown sandy loam about 7 inches thick. The subsoil extends to a depth of 60 inches. It is brown sandy loam to a depth of 40 inches and is brown sandy clay loam below that depth.

The soil is high in natural fertility and is low in organic matter content. The reaction is medium acid to neutral. Permeability is moderately rapid, and the available moisture capacity is high. The root zone is deep. The shrink-swell potential is low. This soil can be worked throughout a wide range of moisture content. It is subject to frequent flooding. The seasonal high water table is at a depth of 4 to 6 feet.

Included in mapping, and making up less than 15 percent of the total acreage, are small areas of Lindside, Newark, and Nolin soils.

On most of the acreage, this soil is used for cultivated crops. It is subject to brief flooding late in winter and early in spring; however, cultivated crops are usually not damaged.

This soil is suited to row crops, pasture, and hay. Good tilth is easily maintained by returning crop residue to the soil. The soil can be worked throughout a wide range of moisture content without forming clods or crusts on the surface.

This soil is best suited to grasses and legumes that can withstand flooding.

This soil is well suited to yellow-poplar, shortleaf pine, eastern cottonwood, and American sycamore. Plant competition is a concern in woodland management.

This soil is poorly suited to urban use and generally is not used for this purpose. It is limited for urban use mainly by flooding and wetness. These limitations are difficult to overcome.

This soil is suited to only certain kinds of recreation uses. Flooding is the main limitation. It can sometimes be overcome by using good design and careful installation procedures.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability class I and woodland suitability group 2o.

HaB—Hammack silt loam, 2 to 6 percent slopes. This soil is deep, well drained, and gently sloping. It is on broad undulating plateaus of the limestone upland. The slopes are smooth and complex. Areas are 5 to 200 acres.

Typically, the surface layer is brown silt loam 9 inches thick. The subsoil extends to a depth of 84 inches. It is brown and yellowish red silt loam or silty clay loam to a depth of about 30 inches. Below that depth, it is yellowish red very cherty silt loam that grades to dark red cherty clay. Limestone bedrock is at a depth of 84 inches.

This soil is high in natural fertility and is moderate in organic matter content. It is neutral to strongly acid throughout. Permeability is moderate, and the available water capacity is high. Tilth is good and can be maintained if crop residue is returned to the soil. The root zone is deep. The shrink-swell potential is low in the upper part of the subsoil and moderate in the lower part.

Included in mapping are small areas of Baxter, Crider, and Pembroke soils. Also included are severely eroded areas and areas where slopes are less than 2 percent and more than 6 percent.

On most of the acreage, this soil is used for cultivated crops. In a few areas, it is used as woodland and pasture (fig. 11).

This soil is well suited to cultivated crops, hay, and pasture. Good tilth is easily maintained by returning crop residue to the soil. If the soil is cultivated, erosion is a moderate hazard. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is well suited to black walnut, yellow-poplar, loblolly pine, shortleaf pine, and Virginia pine. Plant competition is a concern in management.

This soil is suited to most urban uses. The main limitations are steepness of slope and the clayey subsoil material. These limitations can be overcome by good design and careful installation procedures. The low strength of the soil material is a limitation to the use of this soil for local roads and streets.

This soil is suited to intensive recreation uses. Slope is the main limitation to playground use.

This soil has good potential for use as habitat for openland and woodland wildlife.

This map unit is in capability subclass IIe and woodland suitability group 2o.

La—Lawrence silt loam. This soil is deep, somewhat poorly drained, and nearly level. It occurs on terraces and uplands. In the south-central part of the county, areas are as much as 50 to 150 acres. In other parts, areas are only 5 to 15 acres. The slope range is 0 to 2 percent.

Typically, the surface layer is grayish brown silt loam about 7 inches thick. The upper part of the subsoil is yellowish brown silty clay loam mottled with brown and gray. The lower part consists of a compact fragipan

Figure 11.—Pasture of Kentucky 31 fescue and red clover on Hammack silt loam, 2 to 6 percent slopes.

about 42 inches thick. It is mottled gray and yellowish brown silty clay loam.

This soil is medium in natural fertility, and it is low in organic matter content. The reaction is strongly acid to very strongly acid throughout unless the surface layer has been limed. Permeability is slow, and the available water capacity is moderate. The root zone is moderately deep. The shrink-swell potential is low. The soil has a seasonal high water table at a depth of 1 to 2 feet. It is subject to occasional flooding.

Included in mapping are small areas of Newark, Dunning, Melvin, Nicholson, and Robertsville soils. Also included, in sandstone areas, are Sadler and Zanesville soils.

This soil is suited to cultivated crops, hay, and pasture. The main limitations are the fragipan and high water table. Shallow-rooted crops are better adapted to this soil. Surface drainage through open ditches increases yields and permits earlier field operations. Occasional flooding and ponding occur in winter.

This soil is suited to yellow-poplar, white ash, loblolly pine, and American sycamore. Plant competition and limitations to the use of equipment are concerns in woodland management.

This soil is poorly suited to most urban uses and intensive recreation uses. Flooding, slow permeability, and wetness are the main limitations to those uses.

This soil has good potential for use as habitat for openland and woodland wildlife.

This map unit is in capability subclass IIIw and woodland suitability group 2w.

Ld—Lindside silt loam. This soil is deep, moderately well drained, and nearly level. It is on flood plains and formed in recent alluvium. The slope range is 0 to 2 percent.

Typically, the surface layer is brown silt loam about 10 inches thick. The upper part of the subsoil is brown silty clay loam that has a few grayish mottles. The lower part is brown silt loam mottled with yellowish brown and grayish brown. The substratum to a depth of 65 inches is light brownish gray silt loam mottled with shades of brown and gray.

The soil is high in natural fertility and is moderate in organic matter content. It is medium acid to neutral. Permeability is moderate, and the available water capacity is high. The root zone is deep and is easily penetrated by the roots. Tilth is good and is easily maintained. The shrink-swell potential is low. This soil is subject to frequent flooding. The seasonal high water table is at depths of 1.5 to 3 feet.

Included in mapping are a few areas of Nolin, Dunning, and Newark soils.

On most of the acreage, the soil is used for cultivated crops. In a few areas, it is used for hay, pasture, and woodland. It is well suited to woodland use but is limited for most urban uses.

This soil is well suited to cultivated crops, hay, and pasture. Flooding is a hazard during winter and early spring, but row crops are usually not affected. Seedbed preparation, planting, and tillage are sometimes delayed because of excessive wetness. Tilth can be improved by returning crop residue, practicing minimum tillage, and including grasses and legumes in the cropping system.

This soil is well suited to eastern white pine and yellow-poplar. Plant competition is the main concern in woodland management.

This soil is poorly suited to urban uses. Flooding and wetness are the main limitations to those uses.

This soil is suited to most intensive recreation uses. Flooding is the main limitation to those uses. It can sometimes be overcome by using good design and careful installation procedures.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability class I and woodland suitability group 1o.

Me—Melvin silt loam. This soil is deep, poorly drained, and nearly level. It is on flood plains and in alluvial areas on uplands. Areas are 4 to 75 acres. The slope range is 0 to 2 percent.

Typically, the surface layer is grayish brown silt loam mottled with yellowish brown and is about 9 inches thick. The subsoil and substratum to a depth of 62 inches are light brownish gray silty clay loam mottled with yellowish brown.

This soil is high in natural fertility and is moderate in organic matter content. It is slightly acid to mildly alkaline throughout. Permeability is moderate, and the available water capacity is high. The root zone is deep. A seasonal high water table is within 12 inches of the surface for long periods during winter and early spring. This soil is subject to frequent flooding in winter and spring. The shrink-swell potential is low.

Included in mapping are a few intermingled areas of Newark, Lindside, and Dunning soils. Also included are a few areas of Robertsville and Lawrence soils, on low terraces, and areas of strongly acid soils in the sandstone-shale area of the county. The included soils make up less than 15 percent of the map unit.

On most of the acreage, this soil is used for pasture and hay. In a few areas, row crops are grown.

This soil is poorly suited to most cultivated crops. The main limitations are occasional flooding and wetness. Preparation of the soil for planting is often delayed because of excessive wetness. Surface and tile drainage are needed to offset the wetness.

Although this soil is not used extensively for woodland, it is well suited to pin oak, American sycamore, sweetgum, and loblolly pine. Equipment limitations, seedling mortality, and plant competition are the main concerns.

This soil is poorly suited to urban development and intensive recreation uses. Wetness and flooding, the main limitations to urban uses and recreation uses, are difficult to overcome. The low strength of the soil material is a limitation to the use of this soil for local roads and streets.

This soil has fair potential for use as habitat for openland wildlife, and it has good potential for use as habitat for woodland wildlife.

This map unit is in capability subclass IIIw and woodland suitability group 1w.

Ne—Newark silt loam. This soil is deep, somewhat poorly drained, and nearly level. It is on flood plains and in alluvial areas on uplands. Areas are 5 to 150 acres. The slope range is 0 to 2 percent.

Typically, the surface layer is brown silt loam about 11 inches thick. The upper part of the subsoil is yellowish brown silty clay loam mottled with light brownish gray. The lower part of the subsoil and the substratum to a depth of 60 inches are light brownish gray silty clay loam mottled with yellowish brown.

This soil is high in natural fertility and is moderate in organic matter content. It is medium acid to mildly alkaline. Permeability is moderate, and the available water capacity is high. The root zone is deep. A seasonal high water table is 6 to 18 inches below the surface late in winter and early in spring. Flooding is generally a frequent hazard, but it is rare during the growing season. The shrink-swell potential is low.

Included in mapping are a few small areas of Melvin, Lindside, and Dunning soils. Also included are a few

areas of Robertsville and Lawrence soils, on low terraces, and a few areas of somewhat poorly drained soils that have a loam subsoil. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops, hay, pasture, and some woodland. Surface and subsurface drainage will increase the yields.

This soil is suited to yellow-poplar, eastern white pine, sweetgum, eastern cottonwood, loblolly pine, and red maple. Plant competition and limitations to the use of equipment are concerns in woodland management.

Because of flooding and wetness, this soil is poorly suited to urban uses and intensive recreation uses.

This soil has fair potential for use as habitat for openland wildlife, and it has good potential for use as habitat for woodland wildlife.

This map unit is in capability subclass IIw and woodland suitability group 1w.

NhA—Nicholson silt loam, 0 to 2 percent slopes. This soil is deep, moderately well drained, and nearly level. It is on uplands. Areas are 5 to 15 acres.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The upper part of the subsoil is yellowish brown silty clay loam. The lower part consists of a fragipan, about 12 inches thick, of yellowish brown silt loam that is mottled with gray and, below that, dark red clay mottled with light brownish gray. The substratum is yellowish brown clay to a depth of 62 inches.

This soil is medium in natural fertility and is moderate in organic matter content. It is strongly acid to slightly acid throughout, except where the surface layer has been limed. Permeability is moderate above the fragipan and is slow in the fragipan. The available water capacity is moderate. The root zone is moderately deep because of the fragipan at a depth of 24 to 30 inches. A seasonal high water table is within 18 to 30 inches of the surface. The shrink-swell potential is low above the pan and is moderate below the pan.

Included in mapping are a few small areas of Crider, Nolin, Newark, Lawrence, and Pembroke soils and soils, on stream terraces, that are similar to Nicholson soils. The included soils make up less than 15 percent of this map unit.

On most of the acreage, this soil is used for row crops, small grain, hay, pasture (fig. 12), and woodland. It is suited to most cultivated crops, pasture, hay, and woodland.

The main limitations are wetness and the seasonal high water table. Good tilth is easily maintained by returning crop residue to the soil. Minimum tillage, no-tillage, and use of cover crops, including grasses and legumes, in the cropping system help to increase yields.

This soil is suited to yellow-poplar, eastern white pine, black walnut, shortleaf pine, and white ash. Plant competition is a concern in woodland management.

This soil is suited to urban uses. It is limited by wetness and slow permeability for some uses. The limitations can be overcome by good design and careful installation procedures. The low strength of the soil material is a limitation to the use of this soil for local roads and streets.

This soil is suited to recreation uses. Wetness and slow permeability are the main limitations to those uses.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IIw and woodland suitability group 2o.

NhB—Nicholson silt loam, 2 to 6 percent slopes. This soil is deep, moderately well drained, and gently sloping. It is on uplands. Areas are 5 to 10 acres.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The upper part of the subsoil is yellowish brown silty clay loam. The lower part consists of a fragipan, about 12 inches thick, of yellowish brown silt loam that is mottled with gray and, below that, dark red clay mottled with light brownish gray. The substratum is yellowish brown clay to a depth of 62 inches.

This soil is medium in natural fertility and is moderate in organic matter content. It is strongly acid to slightly acid throughout, except where the surface layer has been limed. The permeability is moderate above the fragipan and is slow in the fragipan. The available water capacity is moderate. The root zone is moderately deep because of the fragipan at a depth of about 24 to 30 inches. A seasonal high water table is within 18 to 30 inches of the surface. The shrink-swell potential is low above the pan and is moderate below the pan.

Included in mapping are a few areas of similar soils on stream terraces and small areas of Elk, Crider, and Lawrence soils. Also included are a few small, eroded and gullied areas. The included soils make up less than 15 percent of this map unit.

On most of the acreage, this soil is used for row crops, small grain, hay, and pasture. It is limited for deep-rooted plants mainly because of the fragipan. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system help to reduce runoff and control erosion.

This soil is suited to yellow-poplar, eastern white pine, black walnut, shortleaf pine, and white ash. Plant competition is a concern in woodland management.

This soil is suited to urban uses. It is limited by wetness and slow permeabilty for some uses. The limitations can be overcome by good design and careful installation procedures. The low strength of the soil material is a limitation to the use of the soil for local roads and streets.

This soil is suited to intensive recreation uses. Wetness and slow permeability are the main limitations to those uses.

Figure 12.—Bales of Kentucky 31 fescue and clover hay on Nicholson silt loam, 0 to 2 percent slopes.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IIe and woodland suitability group 2o.

No—Nolin silt loam. This soil is deep, well drained, and nearly level. It is on flood plains in alluvial areas, and in depressions on karst landscapes. Areas are 3 to more than 150 acres along major and minor stream channels. The slope range is 0 to 4 percent.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil to a depth of 60 inches is dark yellowish brown silt loam.

This soil is high in natural fertility and is moderate in organic matter content. Reaction is medium acid to neutral. Permeability is moderate, and the available moisture capacity is high. The shrink-swell potential is low. The root zone is deep. This soil can be worked throughout a wide range of moisture content. It is subject to frequent flooding.

Included in mapping are areas of Dunning, Elk, Lindside, Newark, and Grigsby soils.

On most of the acreage, this soil is used for cultivated crops. In a few areas, it is used for woodland, hay, and pasture.

This soil is well suited to row crops, small grain, hay, and pasture. The main limitation is frequent flooding. Good tilth is easily maintained by returning crop residue to the soil. The soil can be worked throughout a wide

range in moisture content without forming clods and crusts on the surface. The hazard of erosion is slight if the soil is cultivated.

This soil is well suited to sweetgum, yellow-poplar, eastern white pine, eastern cottonwood, white ash, and cherrybark oak. Plant competition is a concern in woodland management.

This soil is poorly suited to most urban uses because of flooding.

This soil is poorly suited to intensive recreation facilities because of flooding. Some types of recreation facilities can be developed by using good design and installation procedures.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass I and woodland suitability group 1o.

PeA—Pembroke silt loam, 0 to 2 percent slopes. This soil is deep, well drained, and nearly level. It is on broad limestone uplands. Some areas are karst. Areas are 6 to 200 acres.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil to a depth of 75 inches is reddish brown and red silty clay loam in the upper part and dark red silty clay in the lower part.

This soil is high in natural fertility and is moderate in organic matter content. It is very strongly acid to medium acid in unlimed areas. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and is easily penetrated by the roots. The shrink-swell potential is low in the upper part of the subsoil and is moderate in the lower part.

Included in mapping are soils that have slopes of more than 2 percent. Also included are soils that are clayey in the upper part of the subsoil and small areas of Crider and Nicholson soils and Nolin soils in depressions. The included soils make up less than 15 percent of the map unit.

On most of the acreage, this soil is used for cultivated crops, pasture, and hay. It is well suited to cultivated crops, pasture, hay, and woodland. If the soil is cultivated, the erosion hazard is slight. Good tilth can be maintained by returning crop residue to the soil. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is well suited to yellow-poplar, eastern white pine, black walnut, loblolly pine, and white ash. Plant competition is the main concern in woodland management.

This soil is suited to urban uses. The main limitations are the shrink-swell potential and the clayey subsoil material. These limitations can be overcome by good design and careful installation procedures. The low strength of the soil material is a limitation to the use of the soil for local roads and streets.

This soil is suited to intensive recreation uses.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass I and woodland suitability group 1o.

PeB—Pembroke silt loam, 2 to 6 percent slopes. This soil is deep, well drained, and gently sloping. It is on broad limestone uplands. Some areas are karst. Areas are 6 to 200 acres.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil to a depth of 75 inches is reddish brown and red silty clay loam in the upper part and dark red silty clay in the lower part.

This soil is high in natural fertility and is moderate in organic matter content. It is very strongly acid to medium acid in unlimed areas. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and is easily penetrated by the roots. The shrink-swell potential is low in the upper part of the subsoil and is moderate in the lower part.

Included in mapping are soils that have slopes of more than 6 percent. Also included are soils that are clayey in the upper part of the subsoil and small areas of Crider, Nicholson, and Nolin soils. The included soils make up less than 15 percent of the map unit.

On most of the acreage, this soil is used for cultivated crops, pasture, and hay. It is well suited to cultivated crops, pasture, hay, and woodland. If the soil is cultivated, erosion is a hazard. Good tilth can be maintained by returning crop residue to the soil. Minimum tillage, no-tillage (fig. 13), and the use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is well suited to yellow-poplar, eastern white pine, black walnut, loblolly pine, and white ash. Plant competition is the main concern in woodland management.

This soil is suited to urban uses. It is limited for those uses mainly by the slope, the shrink-swell potential, and the clayey subsoil material. These limitations can be overcome by good design and careful installation procedures. The low strength of the soil material is a limitation to the use of the soil for local roads and streets.

This soil is well suited to intensive recreation uses.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IIe and woodland suitability group 1o.

PeC—Pembroke silt loam, 6 to 12 percent slopes. This soil is deep, well drained, and sloping. It is on broad

Figure 13.—Soybeans are planted in wheat stubble in a no-till cropping system. The soil is Pembroke silt loam, 2 to 6 percent slopes.

limestone uplands. Some areas have karst topography. Areas are 6 to 200 acres.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil to a depth of 75 inches is reddish brown and red silty clay loam in the upper part and dark red silty clay in the lower part.

This soil is high in natural fertility and is moderate in organic matter content. It is very strongly acid to medium acid in unlimed areas. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and is easily penetrated by the roots. The shrink-swell potential is low in the upper part of the subsoil and is moderate in the lower part.

Included in mapping are soils that have slopes of more than 12 percent. Also included are soils that are clayey in the upper part of the subsoil and small areas of Crider, Nicholson, and Nolin soils. The included soils make up less than 15 percent of the map unit.

On most of the acreage, this soil is used for cultivated crops, pasture, and hay. It is well suited to those crops and to woodland use. Erosion is a severe hazard. Tilth can be improved by returning crop residue to the soil. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is well suited to yellow-poplar, eastern white pine, black walnut, loblolly pine, and white ash. Plant competition is the main concern in woodland management.

This soil is suited to most urban uses. Steepness of slope, shrink-swell potential, and the clayey subsoil material are the main limitations to those uses. These limitations can be overcome by good design and careful installation procedures. The low strength of the soil material is a limitation to the use of the soil for local roads and streets.

This soil is suited to intensive recreation uses. Steepness of slope is the main limitation to those uses.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IIIe and woodland suitability group 1o.

PfC3—Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded. This soil is deep, well drained, and sloping. It is on rolling and karst limestone uplands. Areas are 3 to 50 acres.

Typically, the surface layer is reddish brown silty clay loam about 5 inches thick. The subsoil to a depth of 75 inches or more is red silty clay loam in the upper part and dark red silty clay that grades to red clay in the lower part.

This soil is low in natural fertility and organic matter content. It is medium acid to very strongly acid throughout, except where the surface layer has been limed. Permeability is moderate, and the available water capacity is high. The root zone is deep. The shrink-swell potential is low in the upper part of the subsoil and is moderate in the lower part.

Included in mapping are areas of soils that have slopes of less than 6 percent and more than 12 percent. Also included are small areas of uneroded soil and Crider and Nicholson soils. The included soils make up less than 15 percent of the map unit.

On most of the acreage, this soil is used for cultivated crops, pasture, and hay. It is suited to cultivated crops, pasture, hay, and woodland. If the soil is cultivated, erosion is a very severe hazard. Good tilth can be improved by returning crop residue to the soil. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is suited to yellow-poplar, black walnut, white ash, eastern white pine, and loblolly pine. Plant competition is the main concern in woodland management.

This soil is suited to most urban uses. Steepness of slope, shrink-swell potential, and the clayey subsoil material are the main limitations to those uses. These limitations can be overcome by good design and careful installation procedures. The use of the soil for local roads and streets is limited by the low strength of the soil material.

This soil is suited to intensive recreation uses, but slope is a limitation.

This soil has good potential for use as a habitat for openland and woodland wildlife.

This map unit is in capability subclass IVe and woodland suitability group 1o.

PrB—Pembroke-Urban land complex, 2 to 6 percent slopes. This complex consists of the deep, well drained, gently sloping Pembroke soil and areas of Urban land. This complex is on broad uplands. It commonly is irregular in shape and 15 to 200 acres in size.

Pembroke silt loam makes up about 60 percent of this complex. Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil to a depth of 80 inches is red silty clay loam in the upper part and dark red silty clay to clay in the lower part.

This Pembroke soil is high in natural fertility. Permeability is moderate, and the available water capacity is high. Reaction ranges from very strongly acid to medium acid in unlimed areas. The surface layer contains a moderate amount of organic matter, and it is easy to till. The root zone is deep. The lower part of the subsoil has moderate shrink-swell potential.

Urban land makes up about 35 percent of this complex. Urban land consists mainly of dwellings, streets, sidewalks, small commercial buildings, schools, parking lots, and playgrounds that so obscure or alter the soil that identification is not feasible.

Included in mapping are small areas of Baxter, Caneyville, Fredonia, and Nolin soils and some disturbed areas of Pembroke soils, where the surface layer is clayey and is very low in content of organic matter. Included soils make up about 5 percent of this map unit.

On most of the acreage, the Pembroke soil is used for lawns, playgrounds, parks, and schoolgrounds. In some places, it is in vacant lots that are covered mainly by grass, trees, or weeds.

The Pembroke soil is well suited to most urban uses. The moderate shrink-swell potential, clayey subsoil material, and the steepness of slope are limitations for some uses. These limitations can be overcome by good planning and careful installation procedures. The low strength of the soil material is a limitation to the use of this soil for local roads and streets.

Most of the garden plants, flowers, trees, and shrubs commonly grown in the county grow well on this soil if management is good. Erosion is a moderate hazard if the vegetative cover is removed. In a few disturbed areas, the soil is difficult to work because the surface layer is clayey and low in content of organic matter.

This complex is not assigned to a capability class or woodland group.

PrC—Pembroke-Urban land complex, 6 to 12 percent slopes. This complex consists of the deep, well drained, sloping Pembroke soil and areas of Urban land. The areas are commonly long, irregular in shape, and 15 to 75 acres. The slope range is 6 to 12 percent.

Pembroke silt loam makes up about 55 percent of this complex. Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil to a depth of 60 inches is red silty clay loam in the upper part and dark red silty clay in the lower part.

This Pembroke soil is high in natural fertility. Permeability is moderate, and the available water capacity is high. The reaction ranges from very strongly acid to medium acid in unlimed areas. The surface layer contains a moderate amount of organic matter and it is easy to till. The root zone is deep. The lower part of the subsoil has moderate shrink-swell potential.

Urban land makes up about 40 percent of this complex. Urban land consists mainly of dwellings, streets, sidewalks, commercial buildings, and schools that so obscure or alter the soil that identification is not feasible.

Included in mapping are small areas of Baxter, Caneyville, and Fredonia soils and a few disturbed areas of Pembroke soils, where the surface layer is clayey and is very low in content of organic matter. Included soils make up about 5 percent of this map unit.

On most of the acreage, the Pembroke soil is used for lawns, playgrounds, parks, and schoolgrounds. In some places, it is in vacant lots that are covered mainly by grass, trees, or weeds.

The Pembroke soil is suited to most urban uses. The moderate shrink-swell potential, clayey subsoil material, and steepness of slopes are limitations for some uses. These limitations can be overcome by good planning and careful installation procedures. The low strength of the soil material is a limitation to the use of this soil for local roads and streets.

Most of the garden plants, flowers, trees, and shrubs commonly grown in the county grow well on this soil if management is good. Erosion is a moderate hazard if the vegetative cover is removed. In a few disturbed areas, the soil is difficult to work because the surface layer is clayey and low in content of organic matter.

This complex is not assigned to a capability class or woodland group.

Pt—Pits. This miscellaneous area consists of excavations from which the soil and underlying material have been removed. The limestone bedrock or other material that is exposed supports few or no plants. The pits are limestone quarries and have mostly vertical walls. Most of the pits are in the Mississippian Plateau limestone area in the southern part of Warren County. The areas range from 5 to 50 acres. Included in mapping are small areas of Fredonia and Caneyville soils.

This miscellaneous area is not assigned to a capability class or woodland group.

RfE—Ramsey-Frondorf complex, 20 to 40 percent slopes. This complex consists of areas of Ramsey and Frondorf soils. These soils are shallow to moderately deep and somewhat excessively drained to well drained. They are in horizontal bands perpendicular to the slope. Areas are 75 to 500 acres.

Ramsey loam makes up about 48 percent of each mapped area. Typically, the surface layer is very dark grayish brown loam about 1 inch thick. The subsurface layer is brown channery loam about 3 inches thick. The subsoil, which extends to a depth of 20 inches, is yellowish brown and light yellowish brown channery loam. Below this depth is sandstone bedrock.

This Ramsey soil is low in natural fertility and organic matter content. It is strongly acid or very strongly acid. Permeability is rapid, and the available water capacity is very low. The root zone is shallow, and the shrink-swell potential is low.

Frondorf silt loam makes up about 27 percent of each mapped area. Typically, the surface layer is brown silt loam about 5 inches thick. The upper part of the subsoil is strong brown silty clay loam, and the lower part is yellowish brown silty clay loam mottled pale brown grading to yellowish brown channery silty clay loam mottled light gray and yellowish brown. Soft shale bedrock is at a depth of about 26 inches.

This Frondorf soil is medium in natural fertility and is low in organic matter content. It is strongly to very strongly acid. Permeability and the available water capacity are moderate. The root zone is moderately deep. Bedrock is at a depth of 20 to 40 inches. The shrink-swell potential is low.

Included in mapping are areas of moderately deep clayey soils and small areas of Wellston soils. Also included are small areas of shallow soils that have a silt loam subsoil.

On most of the acreage, the soils are used as woodland. In the less sloping areas they are used as pasture.

The soils are poorly suited to cultivated crops, pasture, and hay. Steepness of slope and the erosion hazard are limitations to those uses.

The soils are suited to woodland. The Ramsey soil is suited to Virginia pine, shortleaf pine, eastern white pine, and loblolly pine. The Frondorf soil is suited to the same species and to yellow-poplar and black walnut on the north-facing slopes. The erosion hazard, equipment limitations, seedling mortality, and plant competition are the main limitations to woodland use.

The soils are poorly suited to urban uses and intensive recreation uses. Steepness of slope and depth to bedrock limit those uses.

The Frondorf soil has good potential for use as habitat for woodland wildlife, but it has poor potential for use as habitat for openland wildlife. The Ramsey soil has very poor potential for use as habitat for openland wildlife and has poor potential for use as habitat for woodland wildlife.

This complex is in capability subclass VIIe. The Frondorf soil is in woodland suitability groups 2r (north aspect) and 3r (south aspect). The Ramsey soil is in woodland suitability groups 3d (north aspect) and 4d (south aspect).

Ro—Robertsville silt loam. This soil is deep, poorly drained, and nearly level. It occurs on broad, smooth uplands, in depressional areas, and on stream terraces. Areas are 5 to 50 acres. The slope range is 0 to 2 percent.

Typically, the surface layer is dark grayish brown silt loam about 10 inches thick. The upper part of the subsoil is light gray silt loam mottled with yellowish brown. The lower part of the subsoil is a fragipan about 22 inches thick. It is gray silty clay loam mottled with

yellowish brown. The substratum to a depth of 70 inches is mottled gray, red, and yellowish red silty clay.

This soil is low in natural fertility and organic matter content. It is strongly acid to very strongly acid through the fragipan and is very strongly acid to neutral below the fragipan. Permeability is slow, and available water capacity is moderate. The shrink-swell potential is low. The depth to the fragipan ranges from 15 to 30 inches. In most areas the soil is occasionally flooded or ponded for brief periods during winter and early spring. A seasonal high water table is within a depth of 1 foot.

Included in mapping are small areas of Lawrence, Melvin, and Nicholson soils, generally less than 5 acres.

On most of the acreage, this soil is used for pasture. In a few areas, it is used for cultivated crops and woodland.

This soil is poorly suited to row crops and small grain. It is limited mainly by a high water table, flooding, and a slowly permeable fragipan. This soil is suited to pasture and hayland and is limited mainly by flooding and the high water table. Excess wetness limits most domestic grasses and legumes.

This soil is well suited to sweetgum, loblolly pine, and American sycamore. The main limitations to woodland use are limitations to the use of equipment, seedling mortality, and plant competition.

This soil is poorly suited to all urban uses. Flooding and wetness are the main limitations to those uses. These limitations can be overcome only by major flood control and drainage measures. The low strength of the soil material is a limitation to the use of the soil for local roads and streets.

This soil is poorly suited to intensive recreation uses. Wetness and flooding are the main limitations to those uses.

This soil has poor potential for use as habitat for openland wildlife, fair potential for use as habitat for woodland wildlife, and good potential for use as habitat for wetland wildlife.

This map unit is in capability subclass IVw and woodland suitability group 1w.

RxE—Rock outcrop-Caneyville complex, 20 to 40 percent slopes. This complex consists of Rock outcrop and steep to very steep, moderately deep, well drained Caneyville soils. Areas are 50 to 300 acres. They occur as alternate narrow strips of Rock outcrop and Caneyville soils about 50 to 200 feet wide along the side slopes.

The Rock outcrop makes up approximately 55 percent of this complex. In places dark gray to black silty clay as much as 4 inches thick covers the limestone. Areas of Rock outcrop are 2 to 100 square feet. The Rock outcrop consists of ledges, cliffs, and irregular or round boulders 1 to 10 feet in diameter.

The Caneyville soils make up about 33 percent of this complex. Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of 27 inches. It is reddish brown silty clay in the upper part and yellowish red clay grading to dark reddish clay in the lower part.

The Caneyville soils are medium in natural fertility and are moderate in organic matter content. Permeability is moderately slow, and the available water capacity is moderate. The reaction is strongly acid to medium acid in the upper part of the profile and it ranges to neutral in the lower part. The root zone is moderately deep. Bedrock is at a depth of 20 to 40 inches. The shrink-swell potential is moderate.

Included in mapping are areas of Fredonia soils and soils that have a thin surface layer of dark grayish brown silt loam. Also included are soils having a clayey surface layer 6 to 12 inches thick over limestone bedrock. The included soils make up approximately 12 percent of this map unit.

On most of the acreage, the Caneyville soils are used for woodland and wildlife habitat. They are poorly suited to cultivated crops, hay, and pasture. The limitations are steepness of slope, rock outcrops, boulders, and cliffs.

The Caneyville soils are suited to woodland use. In areas on the north-facing slopes, they are suited to yellow-poplar, black walnut, and Virginia pine. On the south-facing slopes, they are suited to eastern redcedar, Virginia pine, eastern white pine, shortleaf pine, and loblolly pine. The erosion hazard, limitations to the use of equipment, plant competition, and seedling mortality are concerns in management.

The Caneyville soils are poorly suited to urban uses. The moderate depth to bedrock and steepness of slope are the main limitations to those uses. The low strength of the soil material limits the use of the soils for local roads and streets.

The Caneyville soils are poorly suited to intensive recreation uses. Steepness of slope and the erosion hazard limit those uses.

The Caneyville soils have fair potential for use as habitat for openland wildlife, and they have good potential for use as habitat for woodland wildlife.

This complex is in capability subclass VIIs and woodland suitability groups 2x (north aspect) and 3x (south aspect).

SaA—Sadler silt loam, 0 to 2 percent slopes. This soil is deep, moderately well drained, and nearly level. It is on broad ridgetops. Areas are 5 to 50 acres.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil consists of brownish yellow silty clay loam that is underlain by 3 inches of brownish yellow silty clay loam with brown silt coatings on peds and, below that, a fragipan, about 30 inches thick. The pan is mottled brownish yellow, grayish brown, and yellowish brown silty clay loam. Below this is light brownish gray silt loam mottled with yellowish brown and strong brown. Sandstone bedrock is at a depth of 65 inches.

This soil is medium in natural fertility and is low in organic matter content. It is strongly acid to very strongly

acid throughout, except in limed areas. Permeability is moderate above the fragipan and is slow in the fragipan. The available water capacity is moderate. Tilth is good. The root zone is moderately deep. The seasonal high water table is at a depth of 1 1/2 to 2 feet in late winter and early spring. The shrink-swell potential is low.

Included in mapping are a few small areas of Zanesville, Lawrence, and Wellston soils and a few eroded areas. Areas are generally less than 5 acres.

On most of the acreage, this soil is used for cultivated crops, hay, pasture, and woodland. It is suited to many of the crops and plants grown in the county. The main limitations to cropland use are the fragipan and the erosion hazard. Good tilth can be maintained by returning crop residue to the soil. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system help to slow runoff, control erosion, and increase yields.

This soil is suited to urban uses. It is severely limited for use as a site for sanitary facilities. The main limitations to those uses are wetness and slow permeability. Some of these limitations can be overcome by using good design and careful installation procedures. The low strength of the soil material limits the use of the soil for local roads and streets.

This soil is suited to yellow-poplar, shortleaf pine, eastern white pine, and Virginia pine. The main limitation to woodland use is plant competition.

This soil is suited to intensive recreation uses. Slow permeability and wetness are the main limitations to those uses. Some of the limitations can be overcome by using good design and careful installation procedures.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IIw and woodland suitability group 3o.

SaB—Sadler silt loam, 2 to 6 percent slopes. This soil is deep, moderately well drained, and gently sloping. It is on broad ridgetops. Areas are 5 to 50 acres.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil consists of brownish yellow silty clay loam over 3 inches of brownish yellow silty clay loam with brown silt coatings on peds and, below that, a fragipan, about 30 inches thick. The pan is mottled brownish yellow, grayish brown, and yellowish brown silty clay loam. Below this is brownish gray silt loam mottled with brown and strong brown. Sandstone bedrock is at a depth of 65 inches.

This soil is medium in natural fertility and is low in organic matter content. It is strongly acid to very strongly acid throughout, except in limed areas. Permeability is moderate above the fragipan and is slow in the fragipan. The available water capacity is moderate. Tilth is good. The root zone is moderately deep. The seasonal high water table is at a depth of 1 1/2 to 2 feet in late winter and early spring. The shrink-swell potential is low.

Included in mapping are a few small areas of Zanesville, Lawrence, and Wellston soils and a few eroded areas. Areas are generally less than 5 acres.

On most of the acreage, this soil is used for cultivated crops, hay, pasture, and woodland. It is suited to many of the crops and plants grown in the county. The main limitation to cropland use is the fragipan and the erosion hazard. Good tilth can be maintained by returning crop residue to the soil. Minimum tillage, no-tillage, and the use of cover crops, including grasses and legumes, in the cropping system help to slow runoff, control erosion, and increase yields.

This soil is suited to yellow-poplar, shortleaf pine, eastern white pine, and Virginia pine. Plant competition is the main limitation to woodland use.

This soil is suited to urban uses. It is severely limited for use as a site for sanitary facilities. Steepness of slope, slow permeability, and wetness are the main limitations to those uses. Some of the limitations can be overcome by good design and careful installation. The use of the soil as a site for local roads and streets is limited by the low strength of the soil material.

This soil is suited to intensive recreation uses. Steepness of slope, slow permeability, and wetness are the main limitations to those uses. Some of the limitations can be overcome by good design and careful installation.

This soil has good potential for use as habitat for openland and woodland wildlife.

This map unit is in capability subclass IIe and woodland suitability group 3o.

WeB—Wellston silt loam, 2 to 6 percent slopes. This soil is deep, well drained, and gently sloping. It is on ridgetops and the upper sides of ridges. Areas are 2 to 50 acres.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil is yellowish brown silt loam in the upper part and is strong brown silty clay loam grading to strong brown clay in the lower part. Sandstone bedrock is at a depth of 46 inches.

This soil is medium in natural fertility and is low in organic matter content. It is very strongly acid to medium acid. Permeability is moderate, and the available water capacity is high. Tilth is good. The root zone is deep and is easily penetrated by the roots. The shrink-swell potential is low.

Included in mapping are a few small, eroded areas of soils that have a surface layer of strong brown silt loam. Also included are areas of Sadler, Zanesville, and Frondorf soils. Areas are less than 5 acres.

On most of the acreage, this soil is used for cropland. In a few areas, it is used as pasture and woodland (fig. 14).

This soil is well suited to row crops, small grain, hay, and pasture. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard if the soil is cultivated. Minimum tillage, no-tillage, and

Figure 14.—Tobacco and corn on Wellston silt loam, 2 to 6 percent slopes.

grasses and legumes in the cropping system help to reduce runoff and control erosion.

This soil is well suited to black walnut, yellow-poplar, and eastern white pine. Plant competition is the main limitation to woodland use.

This soil is suited to most urban uses. Steepness of the slope and depth to bedrock are the main limitations to those uses. Some of the limitations can be overcome by using good design and careful installation procedures. The low strength of the soil material is a limitation to the use of the soil for local roads and streets.

This soil is suited to intensive recreation uses. It is limited mainly by slope.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IIe and woodland suitability group 2o.

WeC—Wellston silt loam, 6 to 12 percent slopes. This soil is deep, well drained, and sloping. It is on ridgetops and upper sides of ridges. Areas are 2 to 50 acres.

Typically, the surface layer is brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown silt loam, and the lower part is strong brown silty clay loam grading to strong brown clay. Sandstone bedrock is at a depth of 46 inches.

This soil is medium in natural fertility and is low in organic matter content. It is extremely acid to medium acid. Permeability is moderate, and the available water capacity is high. Tilth is good. The root zone is deep and is easily penetrated by the roots. The shrink-swell potential is low.

Included in mapping are a few small eroded areas of soils that have a surface layer of strong brown silt loam. Also included are areas of Sadler, Zanesville, and Frondorf soils. Areas are less than 5 acres.

On most of the acreage, the soil is used as cropland. In a few areas, it is used as pasture and woodland.

This soil is well suited to row crops, small grain, hay, and pasture. Good tilth is easily maintained by returning

crop residue to the soil. If the soil is cultivated, erosion is a severe hazard. Minimum tillage, no-tillage, and use of grasses and legumes in the cropping system help to reduce runoff and control erosion.

This soil is well suited to black walnut, yellow-poplar, and eastern white pine. Plant competition is the main limitation to woodland use.

This soil is suited to most urban uses. Steepness of slope and depth to bedrock are the main limitations to those uses. Some of the limitations can be overcome by using good design and careful installation procedures. The low strength of the soil material limits the use of this soil for local roads and streets.

This soil is suited to intensive recreation uses. It is limited mainly by slope.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IIIe and woodland suitability group 2o.

ZaB—Zanesville silt loam, 2 to 6 percent slopes. This soil is deep, well drained to moderately well drained, and gently sloping. It is on ridgetops and the upper part of side slopes. The slopes are smooth and convex. Areas are 5 to 100 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of 45 inches. It is strong brown and yellowish brown silty clay loam in the upper part. The lower part is a fragipan of yellowish brown silty clay loam. The substratum is yellowish brown silty clay loam mottled with gray and is 5 to 10 percent sandstone fragments. Sandstone bedrock is at a depth of 56 inches.

This soil is medium in natural fertility and is low in organic-matter content. It is strongly acid to very strongly acid throughout, except where the surface layer has been limed. Permeability is moderately slow to slow, and the available water capacity is moderate. The soil has good tilth and can be worked throughout a wide range of

Figure 15.—An apple orchard on Zanesville silt loam, 2 to 6 percent slopes.

moisture content. The root zone is moderately deep. The seasonal high water table is at a depth of 2 to 3 feet late in winter and early in spring because of the fragipan at a depth of about 23 inches. The shrink-swell potential is low.

Included in mapping are a few small areas of severely eroded soils and soils with slopes of less than 2 percent and more than 6 percent. Also included are a few small areas of Sadler, Lawrence, and Wellston soils. Areas are generally less than 5 acres.

On most of the acreage, this soil is used for cultivated crops, specialty crops, pasture, hay, and woodland (fig. 15). It is suited to most cultivated crops, hay, and pasture grown in the county. The main limitations to cropland use are the erosion hazard and fragipan. Good tilth can be maintained by returning crop residue to the soil. Minimum tillage and use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is suited to most urban uses. Depth to bedrock, slow permeability, and wetness are the main limitations. Some of the limitations can be overcome by using good design and installation procedures. The low strength of the soil material is a limitation to the use of the soil for local roads and streets.

This soil is suited to Virginia pine, eastern white pine, and shortleaf pine. The main limitation to woodland use is plant competition.

This soil is suited to intensive recreation uses. Slope, slow permeability, and wetness are limitations to those uses.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IIe and woodland suitability group 3o.

ZaC—Zanesville silt loam, 6 to 12 percent slopes. This soil is deep, well drained to moderately well drained, and sloping. It is on ridgetops and the upper part of side slopes. The slopes are smooth and convex. Areas are 3 to 30 acres.

Typically, the surface layer is dark grayish brown silt

Figure 16.—Farm pond and fields of corn and Kentucky 31 fescue on Zanesville silt loam, 6 to 12 percent slopes.

loam about 8 inches thick. The subsoil extends to a depth of 45 inches. It is strong brown and yellowish brown silty clay loam in the upper part. The lower part of the subsoil is a fragipan of yellowish brown silty clay loam. The substratum is yellowish brown silty clay loam that is 5 to 10 percent sandstone fragments. Sandstone bedrock is at a depth of 56 inches.

This soil is medium in natural fertility and is low in organic matter content. It is strongly acid to very strongly acid except where the surface layer has been limed. Permeability is moderately slow to slow, and the available water capacity is moderate. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is moderately deep. The seasonal high water table is at a depth of 2 to 3 feet in late winter and early spring because of the fragipan at a depth of about 23 inches. The shrink-swell potential is low.

Included in mapping are a few small areas of severely eroded soils and soils with slopes of less than 6 percent and more than 12 percent. Also included are a few small areas of Sadler, Frondorf, and Wellston soils. Areas are generally less than 5 acres.

On most of the acreage, the soil is used for pasture and hay. In a few areas, it is used for cultivated crops and woodland (fig. 16).

This soil is suited to pasture, hay, and cultivated crops grown in the county. The main limitations to cropland use are the severe erosion hazard and the fragipan. Good tilth can be maintained by returning crop residue to the soil. Minimum tillage, no-tillage, and use of cover crops, including grasses and legumes, in the cropping system slow runoff and help to control erosion.

This soil is suited to urban uses. Slope, wetness, and depth to bedrock are the main limitations to those uses. Some of the limitations can be overcome by using good design and installation procedures. The low strength of the soil material limits the use of the soil for local roads and streets.

This soil is suited to Virginia pine, eastern white pine, and shortleaf pine. The main concern is plant competition.

This soil is suited to intensive recreation uses. Steepness of slope, slow permeability, and wetness are the main limitations to those uses. Some of the limitations can be overcome by using good design and installation procedures.

This soil has good potential for use as habitat for openland wildlife and woodland wildlife.

This map unit is in capability subclass IIIe and woodland suitability group 3o.

prime farmland

Prime farmland, as defined by the U.S. Department of Agriculture, is that land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high crop yields if acceptable farming methods are used. Prime farmland produces the highest yields with minimal inputs of energy and money and farming it results in the least damage to the environment. Prime farmland is of major importance in satisfying the nation's short- and long-range needs for food and fiber. The supply of high quality farmland is limited, and it should be used with wisdom and foresight.

Prime farmland is either currently used for producing food or fiber or is available for this use. Urban or built-up land or water areas are not included. Urban and built-up land includes any unit of land of 10 acres or more in size that is used for residences, industrial sites, commercial sites, construction sites, institutional sites, railroad yards, small parks, cemeteries, airports, golf courses, sanitary landfills, sewage treatment plants, water-control structures and spillways, shooting ranges, and so forth.

Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. It has favorable temperature and growing season and acceptable reaction. It has few or no rocks and is permeable to water and air. Prime farmland is not excessively erodible or saturated with water for long periods or flooded during the growing season. Slope ranges mainly from 0 to 6 percent.

About 123,000 acres, or nearly 35 percent, of Warren County meets the soil requirements for prime farmland. Areas are throughout the county, but most are in the central and southern parts, mainly in map units 4, 5, 6, 7, and 8 of the general soil map. The main crops grown on the prime farmland are corn, wheat, soybeans, tobacco, pasture, and hay.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal land, which generally is more erodible, more droughty, more difficult to cultivate, and less productive.

The map units that make up prime farmland in Warren County are listed in this section. The extent of each map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The use and management of the soils is described in the section "Detailed soil map units."

The soils that have limitations—a high water table or flooding—can qualify for prime farmland if these limitations are overcome by such measures as drainage or flood control. Onsite evaluation is necessary to see if these limitations have been overcome by corrective measures.

For more detailed information on prime farmland, consult the local staff of the Soil Conservation Service.

The soils in the following list are prime farmland except where used for urban or built-up land. Special criteria are indicated in the notes.

BaB—Baxter cherty silt loam, 2 to 6 percent slopes
CaB—Caneyville silt loam, 2 to 6 percent slopes
CrB—Crider silt loam, 2 to 6 percent slopes
Du—Duning silty clay loam [1,2]
ElB—Elk silt loam, 2 to 6 percent slopes
Gr—Grigsby sandy loam [2]
HaB—Hammack silt loam, 2 to 6 percent slopes
La—Lawrence silt loam [1,2]
Ld—Lindside silt loam [2]
Me—Melvin silt loam [1,2]
Ne—Newark silt loam [1,2]
NhA—Nicholson silt loam, 0 to 2 percent slopes
NhB—Nicholson silt loam, 2 to 6 percent slopes
No—Nolin silt loam [2]
PeA—Pembroke silt loam, 0 to 2 percent slopes
PeB—Pembroke silt loam, 2 to 6 percent slopes
SaA—Sadler silt loam, 0 to 2 percent slopes
SaB—Sadler silt loam, 2 to 6 percent slopes
WeB—Wellston silt loam, 2 to 6 percent slopes
ZaB—Zanesville silt loam, 2 to 6 percent slopes

[1] Where the soil is drained sufficiently for crops.

[2] Where the soil is flooded during the growing season less often than once in 2 years.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

Frederick D. Alcott, District Conservationist, Soil Conservation Service, helped in writing this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

The soils in Warren County have good potential for increased production of food. About 500 acres of soils that have good potential for use as cropland is currently used as woodland, and about 25,000 acres is used for pasture. In addition to the reserve productive capacity of these areas, food production can be increased considerably by the use of the latest crop production technology on all cropland in the survey area.

The acreage in crops and pasture has gradually been decreasing as more land is used for urban development. In 1967, about 9,641 acres was urban and built-up land (*6*); the acreage has been increasing at the rate of about 600 acres per year. The use of this soil survey to help make land use decisions that will influence the future role of farming in the survey area is discussed in the section "General soil map units."

Soil erosion is the major concern on about four-fifths of the cropland and pasture in Warren County (*6*). Where the slope is more than 2 percent, erosion is a hazard. Baxter, Caneyville, Crider, Elk, Fredonia, Frondorf, Hammack, Nicholson, Pembroke, Sadler, Wellston, and Zanesville soils, for example, have slopes of more than 2 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging to soils that have a clayey subsoil, such as Baxter, Caneyville, Fredonia, and Pembroke soils. It is also damaging to soils that have a layer in or below the subsoil that limits the depth of the root zone. Such layers include a fragipan, as in Lawrence, Nicholson, Sadler, and Zanesville soils, or bedrock, as in Caneyville, Fredonia, Frondorf, and Wellston soils. Second, soil erosion on farmland results in the sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

On some sloping fields, preparing a good seedbed is difficult because the original friable surface soil has been

eroded away and clayey spots are exposed. Such spots are common in areas of severely eroded Baxter and Pembroke soils.

Erosion control practices provide a protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil losses to amounts that will not reduce the productivity of the soil. On livestock farms, which require pasture and hay, the legumes and grasses in the cropping system reduce erosion on sloping land and also provide nitrogen and improve tilth.

Slopes on Baxter and some Pembroke soils are so short and irregular that contour tillage or terracing is not practical. On these soils, a crop rotation that provides substantial vegetative cover is required to control erosion unless minimum tillage is practiced. Minimizing tillage and leaving crop residue on the surface help to increase infiltration and reduce the hazards of runoff and erosion. These practices can be adapted to most of the upland soils in the survey area. No-tillage for corn and no-tillage of soybeans after wheat harvest are becoming more common on an increasing acreage. This practice helps to reduce erosion on sloping soils and can be adapted to many soils in the survey area. It is more difficult to practice successfully, however, on the soils on a flood plain.

Terraces and diversions reduce the length of a slope and thereby reduce runoff and erosion. They are more practical on deep, well drained soils that have uniform slopes. Crider soils and, in places, Pembroke soils are suitable for terraces. Other soils are less suitable for terraces and diversions because of irregular slopes, excessive wetness in the terrace channels, a clayey subsoil that would be exposed in terrace channels, or bedrock within a depth of 40 inches.

Contouring and stripcropping are suitable erosion control practices in the survey area. They are best adapted to soils that have smooth, uniform slopes, including most areas of the gently sloping and more sloping Crider, Elk, Frondorf, Fredonia, Caneyville, Pembroke, Nicholson, Sadler, Wellston, and Zanesville soils.

Information on the design of erosion control practices for each kind of soil is available in the local offices of the Soil Conservation Service.

Soil drainage is the major management need on about 4 percent of the acreage used for crops and pasture in the survey area (*6*). Some soils are so wet that the production of crops common to the area is generally not possible unless surface and subsurface drainage systems are installed. These wet soils are the poorly drained Melvin and Robertsville soils and the very poorly drained to poorly drained Dunning soils. Unless artificially drained, the somewhat poorly drained soils, for example, Lawrence and Newark soils, are so wet that crops are partly damaged during most years.

The nearly level Nicholson and Sadler soils have a perched water table and slow surface runoff, and they tend to dry out slowly in the early part of the growing season. Artificial drainage is needed in some of the wetter areas of these soils. The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and tile drainage is needed in most areas of the poorly drained and very poorly drained soils used for intensive rowcropping. Drains have to be more closely spaced in slowly permeable soils than in more permeable soils. Permeability is slow in Dunning, Lawrence, and Robertsville soils. Finding adequate outlets for tile drainage systems is difficult in some areas of Lawrence, Dunning, and Newark soils.

Soil fertility is naturally medium to high in most upland soils in the county, except in severely eroded areas. All upland soils are naturally acid. The soils on flood plains, for example, Grigsby, Nolin, Newark, Dunning, and Melvin soils, range from medium acid to mildly alkaline and are naturally higher in plant nutrients than most soils on uplands. Elk, Lawrence, and Robertsville soils, on stream terraces, are medium acid to very strongly acid.

Many soils on uplands are naturally very strongly acid, and in unlimed areas, ground limestone is needed to raise the pH level for good growth of alfalfa and other crops suited only to nearly neutral soils. Available phosphorus and potash levels are naturally low in most of these soils. On all soils, lime and fertilizer should be added according to the results of soil tests, the needs of the crop, and the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is important in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous.

Most of the soils used for crops in the survey area have a surface layer of silt loam that is light in color and moderate or low in organic-matter content. Generally, the structure of such soils is weak, and intense rainfall causes a crust to form on the surface. The crust is hard when dry. Once the crust forms, it reduces infiltration and increases runoff. Crop residue management and the addition of manure and other organic material can help to improve soil structure and reduce crust formation. About three-fourths of the cropland consists of sloping soils that are subject to erosion if they are plowed in fall.

The dark-colored Dunning soils are clayey, and tilth is a concern because the soils often stay wet until late in spring. If they are wet when plowed, they tend to be very cloddy when dry and good seedbeds are difficult to prepare. Fall plowing on such wet soils generally results in good tilth in spring.

Corn, soybeans, and tobacco are the row crops commonly grown in the survey area. Other crops, such as grain sorghum, sunflowers, potatoes, and similar crops, are suited to the soils and climate of the survey area.

Wheat, barley, and oats are the common close-growing crops. Rye, buckwheat, and flax can be grown,

and grass seed can be produced from fescue, orchardgrass, and bluegrass.

Special crops grown commercially in the survey area are vegetables, small fruits, tree fruits, and nursery plants. A small acreage is used for melons, strawberries, raspberries, sweet corn, tomatoes, peppers, and other vegetables and small fruits. In addition, large areas are suited to other special crops, such as grapes and many vegetables. Apples and peaches are the most important tree fruits grown in the survey area.

Deep soils that have good natural drainage and that warm up early in spring are especially well suited to many vegetables and small fruits. Some of the better suited soils for vegetables and fruits in the survey area are the Pembroke, Crider, Baxter, Elk, and Wellston soils. About 71,000 acres of these soils has slope of less than 6 percent. Crops can generally be planted and harvested earlier on all these soils than on the other soils in the survey area.

Most of the well drained soils in the survey area are suited to orchards and nursery plants. Soils on low positions, where air drainage is poor and frost is frequent, however, generally are poorly suited to early vegetables, small fruits, and orchards.

Latest information and suggestions for growing special crops can be obtained from the local offices of the Cooperative Extension Service and the Soil Conservation Service.

Farming and other land uses are competing for large areas of the survey area. Each year additional land is being developed for urban and industrial uses.

In general, the soils on uplands that are well suited to crops are also well suited to urban development. The data about specific soils in this soil survey can be used in planning future land use patterns. The potential of the soil for urban use should be weighed against its potential for use as farmland.

In some areas, however, the soils are well suited to farming but are poorly suited to urban development. In these areas, map units 1 and 8 on the general soil map, the dominant soils are Newark, Nolin, Lawrence, and Nicholson soils. These soils are seriously limited as sites for urban development by flooding or wetness. In many areas these soils have been drained and produce farm crops.

A few soils are only fairly well suited to farming but are generally suited to urban development if public sanitary facilities are installed. An example is map unit 4, dominated by the Fredonia and Caneyville soils. These soils are underlain by bedrock at a depth of 20 to 40 inches, but they are suited to some urban uses.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*12*). Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Charles A. Foster, forester, Soil Conservation Service, helped in writing this section.

Warren County is in the western mesophytic forest region of the Deciduous Forest Formation of eastern North America. The oak-hickory forest type, the most extensive, covers approximately 74 percent of the 87,600 acres of commercial forest land in the county. About 25 percent of the land area in Warren County is woodland.

Most of the forest land is in small holdings that average about 24 acres and are unmanaged. Tree growth averages 33 cubic feet per acre per year, which is well below the potential, 50 cubic feet or more, of most forest sites.

About 30 percent of the landowners own forest land as part of the farm or tract. The stands are not well stocked with desirable trees of high quality, and many tracts are owned for short intervals, usually about 10 years.

Under proper management, tree growth, stocking, and quality can be improved by removal of low-quality trees in stands of all sizes and regeneration of new stands after harvest of sawtimber. This soil survey can be used to identify the most productive soils for woodland use and the trees to favor for commercial use.

The wood-using industry in Warren County consists mainly of two commercial sawmills, one handle mill, and one pallet mill. The products include rough lumber, crossties, chip wood, handle blanks, and fuel wood. Several mills in the adjoining counties also purchase logs and standing trees from the survey area.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant

competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. It was determined at age 30 for eastern cottonwood, age 35 for American sycamore, and age 50 for all other species (*5*). The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

The wildlife population of Warren County consists of an estimated 39 species of mammals, 47 species of terrestrial reptiles and amphibians, and 97 species of birds. More than 200 other species of birds rest in the county during migration.

At present, the kinds of wildlife most important to man are those that furnish recreation in the form of sport

hunting, or economic gain in the form of commercial trapping. In Warren County these are the cottontail rabbit, gray squirrel, fox squirrel, white-tailed deer, raccoon, red fox, mink, muskrat, bobwhite quail, mourning dove, and many kinds of ducks and geese.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants (*4*).

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife (*1*). This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, orchardgrass, bluegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cedar, and hemlock.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife

attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of

gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills.

Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an

appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (*2*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent.

Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

soil and water features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. Only saturated zones within a depth of about 6 feet are indicated. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*13*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 17, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that have an udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*11*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*13*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Baxter series

The Baxter series consists of deep, well drained, moderately permeable soils that formed in material weathered from cherty limestone. These soils are on broad, undulating plateaus and side slopes. Some areas are karst.

Baxter soils are on the same landscape with Pembroke, Crider, Hammack, and Nicholson soils. The Crider, Hammack, Nicholson, and Pembroke soils have a fine-silty control section. Nicholson soils also have a fragipan.

Typical pedon of Baxter cherty silt loam, 6 to 12 percent slopes, in a field 2.75 miles east of Smiths

Grove, 100 yards north of Interstate Highway 65, about 18 miles northeast of Bowling Green:

Ap—0 to 8 inches; brown (10YR 4/3) cherty silt loam; weak very fine granular structure; very friable; common fine roots; 25 percent chert fragments mostly 1/2 inch to 2 inches across; neutral; abrupt smooth boundary.

B1—8 to 15 inches; yellowish red (5YR 5/6) cherty silty clay loam; weak medium subangular blocky structure; friable; common fine roots; few fine continuous pores; nearly continuous thin clay films; 15 percent chert fragments 1/2 inch to 2 inches across; very strongly acid; clear smooth boundary.

B21t—15 to 49 inches; red (2.5YR 4/6) cherty clay with a few medium mottles of strong brown in the lower part of the horizon; moderate fine and medium angular blocky structure parting to very fine angular blocky; very firm; few fine roots; few fine continuous pores; continuous clay films; few thin discontinuous silt coatings; 25 percent chert fragments 1/2 inch to 5 inches across; very strongly acid; gradual wavy boundary.

B22t—49 to 61 inches; red (2.5YR 4/6) cherty clay; common medium prominent strong brown (7.5YR 5/6) and very pale brown (10YR 7/3) mottles; moderate medium angular blocky structure parting to fine and very fine angular blocky; very firm; few fine roots; few fine continuous pores; thin continuous clay films, thicker on some larger peds; 25 percent chert fragments 1/2 inch to 5 inches across; very strongly acid; gradual wavy boundary.

B23t—61 to 88 inches; red (2.5YR 4/6) cherty clay; common, distinct mottles of olive (5YR 5/4); moderate medium angular blocky structure parting to fine and very fine angular blocky; very firm; few fine continuous pores; thin continuous clay films; few medium blocks are massive in the interior; 20 percent chert fragments 1/2 inch to 5 inches across in the upper part and 10 percent in the lower part; very strongly acid; diffuse boundary.

Solum thickness ranges from 60 to 100 inches. Limestone bedrock is at a depth of more than 60 inches. The content of chert fragments ranges from 10 to 30 percent in the A horizon, 10 to 30 percent in the B1t horizon, and 5 to 30 percent in the B2t horizon. Reaction ranges from strongly acid to very strongly acid, except where the surface layer has been limed.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 through 4. Texture is cherty silt loam or cherty silty clay loam.

The B2t horizon has hue of 5YR, 2.5YR, and 10R, value of 4 or 5, and chroma of 4 to 6. It is cherty silty clay, cherty clay, or clay.

Some pedons have a B3 horizon that has hue of 10R, value of 3, and chroma of 6. This horizon is mottled in hue of 5YR to 10YR, value of 3, and chroma of 4 or 2. It is cherty clay or clay.

Caneyville series

The Caneyville series consists of moderately deep, well drained soils that are moderately slowly permeable. These soils formed in material weathered from limestone on uplands. These soils are in the highly dissected areas, which are transitional to the sandstone and shale areas. The slope ranges from 2 to 35 percent.

Caneyville soils are on the same landscape with Pembroke, Crider, and Fredonia soils. In Pembroke and Crider soils bedrock is at a depth of more than 60 inches. Fredonia soils have a hue of 2.5YR or 10R throughout the B2 horizon.

Typical pedon of Caneyville silt loam, 2 to 6 percent slopes, in a pasture field 5.2 miles north of Bowling Green on Kentucky Highway 185; 1.5 miles east on Highway 526; 0.6 mile south on private farm road; 500 feet north of farmhouse:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

B21t—6 to 11 inches; reddish brown (5YR 4/4) silty clay; moderate medium angular and subangular blocky structure; firm; common small roots; many clay films; medium acid; clear smooth boundary.

B22t—11 to 21 inches; yellowish red (5YR 4/6) clay; moderate medium angular blocky structure; very firm; common clay films; common roots; medium acid; clear smooth boundary.

B23t—21 to 27 inches; dark reddish brown (5YR 3/4) clay; moderate medium angular blocky structure; very firm; many clay films; few roots; few chert fragments; few black concretions; slightly acid; abrupt smooth boundary.

R—27 inches; gray limestone.

Solum thickness and depth to bedrock range from 20 to 40 inches. Reaction ranges from strongly acid to medium acid in the upper part of the solum, except where the surface layer has been limed, and from medium acid to neutral in the lower part.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silty loam, silty clay loam, or silty clay.

The B2 horizon has hue of 2.5YR, 5YR, and 7.5YR, value of 4 or 5, and chroma of 4 to 6. Texture in most pedons is clay or silty clay, but in some, it is silty clay loam in the upper part. Small black concretions are common. In the lower part of the B horizon of some pedons, or in the C horizon, if present, the matrix and mottles are in shades of brown, gray, or red.

Crider series

The Crider series consists of deep, gently sloping to sloping, well drained soils that have moderate permeability. These soils formed in loess and the

underlying residuum of limestone. They are on uplands, and some areas are karst. The slope ranges from 2 to 12 percent but is dominantly 2 to 6 percent.

Crider soils are on the same landscape with Baxter, Caneyville, Fredonia, Nicholson, and Pembroke soils. Baxter soils have more than 35 percent clay in the control section, and they have horizons that are more than 15 percent chert. Caneyville and Fredonia soils are fine textured and are moderately deep to bedrock. Nicholson soils have a fragipan. Pembroke soils have hue of 2.5YR or 5YR in the B21 horizon.

Typical pedon of Crider silt loam, 2 to 6 percent slopes, in a field 2.6 miles west of intersection of U.S. Highway 31-W and Kentucky Highway 240; in Woodburn 400 feet north of Kentucky Highway 240:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many roots; few fine pores; neutral; clear smooth boundary.

B21t—9 to 17 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; many fine roots; few fine pores; few clay films; neutral; gradual smooth boundary.

B22t—17 to 28 inches; yellowish red (5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; common clay films; medium acid; gradual smooth boundary.

IIB23t—28 to 50 inches; red (2.5YR 4/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine pores; common clay films; few fine concretions; very strongly acid; clear smooth boundary.

IIB24t—50 to 70 inches; dark red (10R 3/6) clay; few fine distinct mottles of yellowish red (5YR 5/8) and brown (7.5YR 5/4); strong fine angular blocky structure; very firm; sticky, plastic; common clay films; common black concretions; strongly acid.

Solum thickness is more than 60 inches. The depth to bedrock is more than 70 inches. Reaction ranges from neutral to strongly acid in the upper part of the solum and from medium acid to very strongly acid in the lower part.

The Ap horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 2 through 4.

The B2 horizon has hue of 10YR, 7.5YR, and 5YR, value of 4 or 5, and chroma of 4 to 8. Texture is silt loam or silty clay loam. The IIB2t horizon has hue of 10R through 5YR, value of 3 through 5, and chroma of 4 or 6. Texture is silty clay loam, silty clay or clay. Some pedons have a IIB3 horizon. This horizon has the same color and texture range as the IIB2t horizon.

Dunning series

The Dunning series consists of deep, very poorly drained to poorly drained, slowly permeable soils that formed in alluvium from limestone uplands. These nearly level soils are on flood plains and in ponded areas. The slope ranges from 0 to 2 percent.

Dunning soils are on the same landscape with Melvin, Newark, Lindside, and Nolin soils. These soils have less than 35 percent clay in the control section and do not have mollic epipedons.

Typical pedon of Dunning silty clay loam, in a field 0.7 mile east of intersection of U.S. Highway 68 and Bogle Lane, 200 feet north of Bogle Lane and 400 feet west of Brush Creek, about 10 miles southwest of Bowling Green:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay loam; moderate medium angular blocky structure; firm; many fine roots; neutral; gradual smooth boundary.

A1g—9 to 16 inches; very dark gray (10YR 3/1) silty clay loam; few fine distinct mottles of dark yellowish brown (10YR 4/6); moderate medium angular blocky structure; firm; common fine roots; mildly alkaline; gradual smooth boundary.

B21g—16 to 25 inches; dark gray (10YR 4/1) silty clay; few fine prominent mottles of dark yellowish brown (10YR 4/6); moderate medium blocky structure; firm; common roots; mildly alkaline; gradual smooth boundary.

B22g—25 to 43 inches; dark gray (10YR 4/1) clay; common fine distinct mottles of brown (10YR 4/3); moderate medium blocky structure; firm; few roots; mildly alkaline; gradual smooth boundary.

Cg—43 to 65 inches; dark gray (5Y 4/1) clay; common medium distinct mottles of light olive brown (2.5Y 5/6) and brown (7.5YR 5/4); massive; firm; few roots; common brown concretions; mildly alkaline.

Solum thickness ranges from 36 to 48 inches, and depth to limestone bedrock is more than 60 inches. Reaction ranges from slightly acid to mildly alkaline throughout.

The Ap horizon has hue of 10YR, value of 3, and chroma of 1 or 2. Texture is silty clay loam.

The A1g horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is silty clay loam. Most pedons are mottled in shades of brown.

The Bg horizon has hue of 10YR, value of 4, and chroma of 1 or 2. Texture is silty clay loam, silty clay, or clay. The mottles are in shades of brown.

The Cg horizon has hue of 5Y, value of 4, and chroma of 0 or 1. Texture is silty clay loam, silty clay, or clay. The mottles are in shades of brown or olive.

Elk series

The Elk series consists of deep, well drained, moderately permeable soils that formed in mixed alluvium from limestone. These gently sloping soils are on stream terraces. The slope ranges from 2 to 6 percent.

Elk soils are on the same landscape with Nolin and Newark soils of the flood plains and the Nicholson soils of the stream terraces. The Nolin soils are well drained and do not have an argillic horizon. The Newark soils are somewhat poorly drained. The Nicholson soils are moderately well drained, and they have a fragipan.

Typical pedon of Elk silt loam, 2 to 6 percent slopes, in a field at the intersection of U.S. Highway 231 and Drakes Creek, 1/4 mile northwest of bridge and 150 feet south of Drakes Creek, about 5 miles south of Bowling Green:

Ap—0 to 10 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many fine roots; medium acid; gradual smooth boundary.

B1—10 to 20 inches; brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; common roots; medium acid; gradual smooth boundary.

B21t—20 to 32 inches; brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; common roots; thin patchy clay films; about 2 percent chert pebbles; strongly acid; gradual smooth boundary.

B22t—32 to 42 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few roots; thin patchy clay films; few small black concretions; about 2 percent chert pebbles 1/2 inch to 1 inch in diameter; strongly acid; clear smooth boundary.

C—42 to 65 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) mottles; massive; firm; few small black concretions; medium acid.

Solum thickness ranges from 40 to 54 inches. Depth to bedrock ranges from 5 to 20 feet. In some pedons, 1 to 5 percent of the B horizon is small pebbles. The reaction ranges from strongly acid to medium acid, except where the surface layer has been limed.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. The structure is weak or moderate, fine or medium, granular. Texture is silt loam.

The B horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. The texture is silt loam or silty clay loam. Some pedons have a few mottles in shades of brown and gray in the lower part of the B2t horizon.

The C horizon has the same color and texture as the B horizon, and in some pedons, it is stratified with loamy or gravelly material.

Fredonia series

The Fredonia series consists of moderately deep, well drained soils. These soils formed in material weathered from limestone on uplands. Permeability is moderately slow to slow. The slope ranges from 2 to 12 percent.

Fredonia soils are on the same landscape with Pembroke, Crider, and Caneyville soils. In the Pembroke and Crider soils the solum thickness and depth to bedrock are more than 60 inches, and these soils have a fine-silty control section. In Caneyville soils the B horizon has hue yellower than 2.5YR.

Typical pedon of Fredonia silt loam, very rocky, 2 to 12 percent slopes, in a pasture 400 feet east of Petros-Browning Road and 0.4 mile northeast of Petros at junction of U.S. Highway 68 and Petros-Browning Road, 10 miles southwest from Bowling Green:

Ap—0 to 5 inches; reddish brown (5YR 4/4) silt loam; moderate fine granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

B21t—5 to 22 inches; dark red (2.5YR 3/6) silty clay; moderate fine and medium subangular blocky structure; firm; common fine roots; many thin clay films; few very fine black concretions; medium acid; gradual smooth boundary.

B22t—22 to 37 inches; dusky red (10R 3/4) clay; moderate medium angular blocky structure; very firm; common fine roots; many clay films; few fine black concretions; few fine chert fragments; slightly acid; abrupt wavy boundary.

R—37 inches; light gray, massive limestone rock.

Solum thickness and depth to bedrock range from 20 to 40 inches. Except where the surface layer has been limed, the reaction ranges from strongly acid to medium acid in the upper part of the solum and to neutral in the lower part.

The A horizon has hue of 5YR, 7.5YR, and 10YR, value of 3 or 4, and chroma of 2 to 4. Texture is silt loam or silty clay loam.

The B2 horizon has hue of 10R or 2.5YR, value of 3 or 4, and chroma of 4 to 6. The texture is silty clay or clay, except in some pedons, where this horizon is silty clay loam in the upper part.

Frondorf series

The Frondorf series consists of moderately deep, well drained moderately permeable soils that formed in loess over residuum of sandstone and shale. These soils are on side slopes and narrow ridgetops. The slope ranges from 6 to 40 percent.

Frondorf soils are on the same landscape with Ramsey, Zanesville, and Wellston soils. Ramsey soils are shallow to sandstone bedrock and have a cambic horizon. Wellston soils are deep to sandstone bedrock. Zanesville soils have a fragipan and are deep to bedrock.

Typical pedon of Frondorf silt loam, 12 to 20 percent slopes, in a pasture 2.3 miles north of the intersection of Kentucky Highway 263 and Threlkel Ferry Road in Richardsville; 100 feet east of Threlkel Ferry Road; 300 feet south of private drive:

Ap—0 to 5 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many fine roots; few fine and medium pores; slighty acid; clear smooth boundary.

B21t—5 to 11 inches; strong brown (7.5YR 5/6) silty clay loam; moderate fine subangular blocky structure; friable; common fine roots; few fine and medium pores; few clay films; very strongly acid; clear smooth boundary.

B22t—11 to 18 inches; yellowish brown (10YR 5/6) silty clay loam; few fine faint mottles of pale brown (10YR 6/3); moderate medium angular and subangular blocky structure; firm; common fine roots; few fine and medium pores; common clay films; 2 percent sandstone and shale fragments up to 3 inches across; very strongly acid; clear smooth boundary.

IIB23t—18 to 26 inches; yellowish brown (10YR 5/6) channery silty clay loam; few fine distinct mottles of light gray (10YR 7/2) and few fine faint mottles of yellowish brown (10YR 5/8); weak medium angular blocky structure; firm; few fine pores; common clay films; 60 percent sandstone and shale fragments up to 5 inches across; very strongly acid; clear smooth boundary.

Cr—26 inches; shale bedrock.

Solum thickness and depth to shale or sandstone bedrock range from 20 to 40 inches. The loess mantle ranges from 12 to 24 inches in thickness. The content of fragments ranges from 0 to 5 percent to the depth of the lithological discontinuity and from 15 to 75 percent below. Reaction ranges from strongly acid to very strongly acid, except where the surface layer has been limed.

The A horizon has hue of 10YR, value of 3 through 6, and chroma of 2 through 4. Texture is silt loam.

The B horizon has hue of 10YR or 7.5YR, value of 4 through 6, and chroma of 4 through 8. Texture is silt loam or silty clay loam. Most pedons have a few fine mottles in shades of brown in the lower part of the B horizon.

The IIB horizon has hue of 10YR or 7.5YR, value of 4 through 6, and chroma of 4 through 8. Texture is channery silty clay loam or silty clay. Most pedons have a few mottles in shades of gray or brown.

Some pedons have a C horizon. This horizon has the same color and texture range as the IIB3 horizon.

Grigsby series

The Grigsby series consists of deep, well drained soils that formed in alluvium from limestone, sandstone, shale, and loess. Permeability is moderate to rapid. These nearly level soils are on flood plains and low positions, generally in bends along the Green and Barren Rivers. They are subject to floods of short duration mostly during winter and early spring. The slope ranges from 0 to 4 percent.

Grigsby soils are on the same landscape with Lindside, Melvin, Newark, and Nolin soils. Lindside soils have low chroma mottles within 24 inches of the surface. Nolin soils are medium textured. Melvin and Newark soils have dominantly low chroma within 20 inches of the surface.

Typical pedon of Grigsby sandy loam in a cultivated field, 16 miles north of Bowling Green on Kentucky Highway 185 at the boundary of Butler and Warren Counties, 300 feet east of the bridge and 50 feet south of Green River:

Ap—0 to 7 inches; very dark yellowish brown (10YR 4/4) sandy loam; weak fine granular structure; very friable; many fine roots; neutral; gradual smooth boundary.

B21—7 to 40 inches; brown (10YR 4/3) sandy loam; moderate medium granular structure; friable; common fine roots; neutral; gradual smooth boundary.

B22—40 to 60 inches; brown (10YR 4/3) sandy clay loam; moderate medium granular structure; friable; few sandstone fragments; neutral.

Solum thickness is more than 40 inches, and depth to bedrock is more than 60 inches. Reaction is medium acid to neutral throughout the profile. The content of coarse fragments ranges from 0 to about 10 percent.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. Texture is dominantly sandy loam but includes loam. In some pedons, the B1 horizon is similar in color and texture to the Ap horizon.

The B2 horizon has hue of 10YR, value of 4, and chroma of 3 or 4. In some pedons, mottles of pale brown are below a depth of 24 inches. Texture ranges from sandy loam to loam in the upper part of the B horizon and is dominantly sandy clay loam in the lower part.

Some pedons have a C horizon. Texture and colors of this horizon are similar to those of the B horizon.

In this survey area, Grigsby soils are taxadjuncts to the Grigsby series because they have more clay below a depth of 40 inches and have a thicker solum than is defined in the range for the series.

Hammack series

The Hammack series consists of deep, well drained, moderately permeable soils that formed in loess over cherty limestone residuum. These soils are on broad, undulating upland plains. The slope ranges from 2 to 6 percent.

Hammack soils are on the same landscape with Pembroke, Crider, Fredonia, and Baxter soils. Crider and Pembroke soils do not have a cherty IIB horizon. Fredonia and Baxter soils have a clayey control section. Baxter soils are cherty.

Typical pedon of Hammack silt loam, 2 to 6 percent slopes, in a pasture 5.6 miles northeast of the

intersection of U.S. Highway 31-W and U.S. Highway 68 in Warren County; 1.4 miles east on paved road; 1.3 miles northeast, 50 feet north of road:

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine granular structure; very friable; many fine roots; slightly acid; clear smooth boundary.

B21t—9 to 17 inches; brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; common fine roots; few small black concretions; medium acid; clear smooth boundary.

B22t—17 to 30 inches; yellowish red (5YR 4/6) silty clay loam; moderate medium subangular blocky structure; firm; common roots; few thin clay films; common black concretions; medium acid; abrupt wavy boundary.

IIB23—30 to 41 inches; yellowish red (5YR 4/6) very cherty silt loam; moderate medium subangular blocky structure; firm; few small roots; 60 to 75 percent chert fragments; 65 percent chert less than 3 inches in diameter; medium acid; clear smooth boundary.

IIB24t—41 to 54 inches; dark red (2.5YR 3/6) cherty clay; moderate medium subangular blocky structure; firm; common clay films; common small black concretions; 30 percent chert fragments; strongly acid; clear smooth boundary.

IIB25t—54 to 84 inches; dark red (10R 3/6) clay; moderate medium subangular blocky structure; very firm; many clay films; common black concretions; strongly acid.

R—84 inches; limestone bedrock.

Solum thickness and depth to bedrock are 60 inches or more. Reaction ranges from strongly acid to neutral. The upper part of the solum formed in loess 20 to 40 inches thick. The content of chert fragments ranges from 0 to 5 percent in the upper part of the solum, from 35 to 75 percent in the upper part of the IIB horizon, and from 0 to 80 percent in the lower part of the IIB horizon.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Texture is silt loam or silty clay loam.

The B horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 or 6. The texture is silt loam or silty clay loam.

The IIB horizon has hue of 5YR, 2.5YR, and 10R, value of 3 or 4, and chroma of 4 or 6. The upper 5 to 25 inches of this horizon is cherty silt loam or cherty silty clay loam, and the lower part ranges from cherty clay to silty clay.

In this survey area, Hammack soils are considered taxadjuncts to the series because they do not have silt coatings in the upper part of the IIB horizon.

Lawrence series

The Lawrence series consists of deep, somewhat poorly drained, slowly permeable soils. These soils formed in old alluvium or residuum of limestone, shale, siltstone, and sandstone. They are on stream terraces and on nearly level, concave uplands. The slopes are dominantly 1 percent but range from 0 to 2 percent.

Lawrence soils are on the same landscape with Nicholson, Melvin, Robertsville, Sadler, and Zanesville soils. Nicholson soils are better drained. Sadler and Zanesville soils are less mottled and are better drained than Lawrence soils. They occur in the mixed sandstone and shale section of the survey area. Robertsville soils are poorly drained and are grayer throughout the profile. Melvin soils do not have a fragipan.

Typical pedon of Lawrence silt loam in a cultivated field about 8 miles south of Bowling Green, 1,250 feet south of road; 1/2 mile west of store at Plano:

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; very friable; common fine roots; few small brown concretions; strongly acid; abrupt smooth boundary.

B21t—7 to 14 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct light yellowish brown (2.5Y 6/4) mottles; moderate medium subangular blocky structure; friable; common fine roots; thin continuous clay films; very strongly acid; clear smooth boundary.

B22t—14 to 18 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct very pale brown (10YR 7/4) and many distinct light brownish gray (10YR 6/2) mottles; moderate medium angular blocky structure; friable; few small black and brown concretions; thin continuous clay films; few white silt coatings on peds; strongly acid; clear smooth boundary.

Bx1—18 to 40 inches; mottled gray (10YR 5/1) and yellowish brown (10YR 5/6) silty clay loam; weak very coarse prismatic structure parting to weak medium subangular and angular blocky; very firm; compact and brittle; few fine roots between prisms; few thin silt coatings on prisms; common thin clay films on blocks; strongly acid; gradual smooth boundary.

Bx2—40 to 60 inches; mottled gray (10YR 5/1) and yellowish brown (10YR 5/6) silty clay loam; moderate very coarse prismatic structure parting to moderate medium subangular blocky; very firm; compact and brittle; few fine roots between prisms; few silt coatings on prisms; common thin clay films on blocks; strongly acid.

The solum ranges from 40 to 80 inches in thickness. Depth to bedrock is more than 60 inches. In unlimed areas, the reaction ranges from strongly acid to very strongly acid throughout the profile.

Thickness of the A horizon is 6 to 10 inches. The Ap horizon has hue of 10YR through 2.5YR, value of 4 or 5, and chroma of 2 to 4. Texture of the Ap horizon is silt loam.

The B2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma 3 to 6. It is mottled in shades of gray or brown. Texture is silt loam or silty clay loam.

The Bx horizon is more than 30 inches thick. The matrix in the Bx horizon and the mottles are in hue of 7.5YR through 2.5Y, value of 5 or 7, and chroma of 0 to 8. Many pedons are equally mottled with shades of gray or brown. Texture is silt loam or silty clay loam.

Some pedons have a B3 or C horizon that is similar in color to the Bx horizon. Texture is silt loam, silty clay loam, or silty clay.

Lindside series

The Lindside series consists of deep, moderately well drained, moderately permeable soils that formed in recent alluvial material. These soils are on flood plains and in small drainageways. The slope ranges from 0 to 2 percent.

Lindside soils are on the same landscape with Newark, Nolin, Melvin, and Dunning soils. Newark soils are somewhat poorly drained. Melvin and Dunning soils are poorly drained. Dunning soils have a mollic epipedon and contain more than 35 percent clay in the control section. Nolin soils are well drained and do not have mottles with chroma of 2 within 24 inches of the surface.

Typical pedon of Lindside silt loam, 6.9 miles northwest of Richardsville, 0.8 mile south of Green River; 0.8 mile north of Kentucky Highway 263:

Ap—0 to 10 inches; brown (10YR 4/3) silt loam; moderate fine granular structure; friable; few fine roots; neutral; clear smooth boundary.

B1—10 to 22 inches; brown (10YR 4/3) silty clay loam; few fine faint mottles of light brownish gray (10YR 6/2); moderate medium subangular blocky structure; firm; few fine roots; few fine pores; medium acid; gradual wavy boundary.

B2—22 to 42 inches; dark brown (10YR 4/3) silt loam; common fine distinct mottles of yellowish brown (10YR 5/8) and grayish brown (10YR 5/2); moderate medium subangular blocky structure; firm; common fine pores; medium acid; clear smooth boundary.

C—42 to 65 inches; light brownish gray (10YR 6/2) silt loam; common distinct dark brown (10YR 3/3), light yellowish brown (10YR 6/4), and light gray (2.5Y 7/2) mottles; massive; firm; few small gravels; medium acid.

Solum thickness ranges from 25 to 50 inches, and depth to bedrock is 60 inches or more. Reaction ranges from medium acid to neutral. The content of coarse fragments ranges up to 5 percent.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3. It is silt loam, sandy loam, or silty clay loam.

The B horizon has hue of 7.5YR through 2.5Y, value of 4 or 5, and chroma of 3 through 6. It is silt loam or silty clay loam.

The C horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 1 through 4. It is silt loam, silty clay loam, or loam.

Melvin series

The Melvin series consists of deep, poorly drained, moderately permeable soils that formed in mixed alluvium from limestone, siltstone, shale, sandstone, and loess. These nearly level soils are on flood plains and in depressions. The slope ranges from 0 to 2 percent.

Melvin soils are on the same landscape with Dunning, Lindside, Newark, Nolin, and Robertsville soils. Dunning soils have a mollic epipedon and contain more than 35 percent clay in the control section. Lindside, Newark, and Nolin are better drained than Melvin soils. Robertsville soils have a fragipan.

Typical pedon of Melvin silt loam, approximately 14 miles northwest of Bowling Green, in a cultivated field north of a dirt road; 0.6 mile west of Ridge Road and 0.5 mile south of intersection of Ridge Road and Kentucky Highway 263:

Ap—0 to 9 inches; grayish brown (10YR 5/2) silt loam; few fine distinct mottles of yellowish brown (10YR 5/8); weak fine granular structure; friable; common fine roots; mildly alkaline; abrupt smooth boundary.

B2g—9 to 33 inches; light brownish gray (10YR 6/2) silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/4); moderate medium subangular blocky structure; friable; few fine roots; mildly alkaline; gradual smooth boundary.

Cg—33 to 62 inches; light brownish gray (10YR 6/2) silty clay loam; few fine distinct yellowish brown (10YR 5/4, 5/6) mottles; massive; friable; few fine pores; few black concretions; mildly alkaline.

The solum thickness ranges from 20 to 40 inches. Depth to bedrock is more than 60 inches. In some pedons, content of concretions ranges up to 2 percent. Reaction ranges from slightly acid to mildly alkaline.

The A horizon has hue of 10YR through 5Y, value of 4 to 6, and chroma of 1 to 3. Some pedons are mottled in shades of brown and gray. Texture is silt loam or silty clay loam.

The B2g horizon has hue of 10YR to 5Y, value of 6 or 7, and chroma of 1 or 2, or value of 4 or 5 and chroma of 0 to 1. It is mottled in shades of brown and red. Texture is silt loam or silty clay loam.

The Cg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 0 to 2. It is mottled in shades of brown. Texture is silt loam or silty clay loam. In some pedons, a stratified layer of loam and clay is below a depth of 40 inches.

Newark series

The Newark series consists of deep, somewhat poorly drained, moderately permeable soils that formed in mixed alluvium from limestone, shale, sandstone, and loess. These nearly level soils are on flood plains and in local alluvial upland areas. The slope ranges from 0 to 2 percent.

Newark soils are on the same landscape with Nolin, Grigsby, Lindside, Melvin, and Dunning soils. Nolin soils have no gray mottles in the upper 24 inches of the profile. The control section of Grigsby soils contains more sand and less clay than that of Newark soils. Lindside soils have no dominantly gray layers in the upper 24 inches of the profile. Melvin soils have dominantly gray layers between the Ap horizon and a depth of 30 inches. Dunning soils have a mollic epipedon and contain more than 35 percent clay in the control section.

Typical pedon of Newark silt loam, about 6 miles northwest of Bowling Green, 150 feet south of Middle Bridge Road; 425 feet east of Drakes Creek; 1.45 miles east of Middle Bridge Road; 2 miles northeast on Hunt Road to Kentucky Highway 234:

Ap—0 to 11 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many fine roots; few fine pores; mildly alkaline; abrupt smooth boundary.

B21—11 to 18 inches; yellowish brown (10YR 5/4) silty clay loam; many fine and medium faint mottles of light brownish gray (10YR 6/2); weak fine granular structure; very friable; common fine roots; few fine and medium pores; slightly acid; clear smooth boundary.

B22g—18 to 28 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium distinct mottles of yellowish brown (10YR 5/4); weak fine subangular blocky structure; friable; few fine and medium pores; few fine black concretions; slightly acid; clear smooth boundary.

Cg—28 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; few medium faint mottles of light yellowish brown (2.5Y 6/4) and few fine pores; few medium black concretions increasing in number with depth; medium acid.

Solum thickness ranges from 22 to 40 inches, and depth to bedrock is more than 60 inches. The content of coarse fragments ranges up to 5 percent to a depth of 30 inches, and it ranges up to 15 percent below. Reaction ranges from medium acid to mildly alkaline.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 through 4. Some pedons are mottled in shades of brown or gray.

The B horizon has hue of 10YR or 2.5YR, value of 4 to 7, and chroma of 0 to 4. It is mottled in shades of brown and gray. Texture is silt loam or silty clay loam.

The Cg horizon has colors and mottles similar to those in the B horizon. Texture is silt loam or silty clay loam. Thin layers of loam, fine sandy loam, or silty clay are in some pedons.

Nicholson series

The Nicholson series consists of deep, moderately well drained soils that have a permeable fragipan. These soils formed partly in loess and partly in clayey residuum. They occur on uplands and stream terraces. The slope ranges from 0 to 6 percent.

Nicholson soils are on the same landscape with Crider, Pembroke, Nolin, and Elk soils. The associated soils are well drained and do not have a fragipan.

Typical pedon of Nicholson silt loam, 0 to 2 percent slopes, in a cultivated field 0.8 mile north of store at Plano on Kentucky Highway 622 to intersection of Sim Road, 0.5 mile west on Sim Road, 1,200 feet south of road:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; very friable; common fine roots; slightly acid; clear smooth boundary.

B21t—6 to 19 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; few clay films; slightly acid; gradual smooth boundary.

B22t—19 to 25 inches; yellowish brown (10YR 5/4) silty clay loam; a few medium faint brown (10YR 6/3) and red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; common clay films; strongly acid; granular wavy boundary.

Bx—25 to 37 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct mottles of gray (10YR 6/1); strong very coarse prismatic structure parting to medium angular blocky; firm; compact and brittle; few small roots between prisms; common clay films; common black concretions; strongly acid; gradual smooth boundary.

IIB3t—37 to 57 inches; red (2.5YR 4/6) clay; common medium distinct mottles of light brownish gray (10YR 6/2); moderate coarse angular blocky structure; firm; common clay films; few black concretions; strongly acid; gradual wavy boundary.

IIC—57 to 62 inches; yellowish brown (10YR 5/6) clay; common medium light brownish gray (2.5Y 6/2) mottles; massive; very firm; sticky and plastic; medium acid.

The solum thickness is 40 to 80 inches. The depth to bedrock is more than 60 inches. The depth to the fragipan is 24 to 30 inches. Reaction ranges from strongly to slightly acid.

The Ap horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 through 4.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 through 6. Texture is silt loam or silty clay loam. A few faint, pale brown mottles are in the lower part of most pedons. Some pedons have a B1 horizon.

The Bx horizon has hue of 7.5YR through 2.5Y, value of 3 through 5, and chroma of 4 through 8, and it has common mottles with chroma of 2 or less. Texture is silt loam or silty clay loam.

The IIB3t horizon has hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 4 to 6, and it has common mottles with chroma of 2 or less. Texture is silty clay or clay.

The IIC horizon has the same color and texture as those of the IIB horizon. The content of coarse fragments ranges up to 35 percent. Some pedons have relic rock structure.

Nolin series

The Nolin series consists of deep, well drained soils formed in alluvium from limestone, sandstone, shale, and loess. These nearly level soils are on flood plains and in upland depressions. The slope ranges from 0 to 4 percent.

Nolin soils are on the same landscape with Elk, Lindside, Melvin, Dunning, and Newark soils. Elk soils are on low stream terraces and have an argillic horizon. Lindside soils are moderately well drained and have low chroma mottles within a depth of 24 inches. Melvin soils are poorly drained, and Newark soils are somewhat poorly drained. Dunning soils have a mollic epipedon and are more than 35 percent clay in the control section.

Typical pedon of Nolin silt loam in a cultivated field about 16 miles north of Bowling Green; 0.32 mile east of the confluence of the Green River and Barren River and 1.3 miles northwest of the intersection of Kentucky Highway 263 and Ridge Road:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many fine roots; medium acid; gradual smooth boundary.

B21—9 to 24 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; common fine roots; medium acid; gradual smooth boundary.

B22—24 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; few black concretions; medium acid.

Solum thickness is 40 inches or more. Reaction is medium acid to neutral throughout the profile. The depth to bedrock is more than 5 feet.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The texture is silty clay loam or silt loam.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. In some pedons, mottles of 2 or lower chroma occur below a depth of 24 inches. Texture is silt loam or silty clay loam.

Pembroke series

The Pembroke series consists of deep, well drained, moderately permeable soils that formed in loess underlain by residuum of limestone and old alluvium. These soils are on broad upland ridges, side slopes, karst ridges, and karst side slopes. The slope ranges from 0 to 12 percent.

Pembroke soils are on the same landscape with Baxter, Caneyville, Crider, Fredonia, Hammack, Lawrence, and Nicholson soils. Baxter soils have more than 35 percent clay in the control section and have an argillic horizon that is more than 15 percent chert. Caneyville and Fredonia soils are moderately deep to bedrock, and they have more than 35 percent clay in the control section. Crider soils have a hue of yellowish brown and strong brown in the B21t horizon. Hammack soils have a cherty IIB horizon. Lawrence and Nicholson soils have a fragipan.

Typical pedon of Pembroke silt loam, 2 to 6 percent slopes, in a cultivated field 10 miles south of Bowling Green on U.S. Highway 31W:

Ap—0 to 9 inches; dark brown (7.5YR 3/2) silt loam; weak to moderate fine granular structure; very friable; many roots; neutral; clear smooth boundary.

B1—9 to 16 inches; reddish brown (5YR 4/4) silty clay loam; weak fine subangular blocky structure; friable; many fine roots; few clay films; common very small black concretions; slightly acid; gradual smooth boundary.

B21t—16 to 33 inches; red (2.5YR 4/6) silty clay loam; moderate medium subangular blocky structure; friable; common roots; common clay films; common very small black concretions; medium acid; gradual smooth boundary.

B22t—33 to 45 inches; dark red (2.5YR 3/6) silty clay loam; moderate medium subangular blocky structure; friable; few roots; common clay films; common black stains on peds; common black concretions; few small chert fragments; strongly acid; gradual smooth boundary.

B23t—45 to 75 inches; dark red (2.5YR 3/6) silty clay; moderate medium subangular blocky structure; firm; common clay films; common black stains on peds; common black concretions; few small chert fragments; strongly acid; gradual wavy boundary.

C—75 to 80 inches; dark red (2.5YR 3/6) silty clay; common medium distinct variegations of strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2); weak coarse angular blocky structure; very firm; few black concretions; few small chert fragments; very strongly acid.

Solum thickness is more than 60 inches. The depth to bedrock is more than 60 inches. Reaction ranges from very strongly acid to medium acid, except where the surface layer has been limed. The content of chert

fragments ranges up to 5 percent, by volume, in the upper part of the solum and up to 15 percent in the lower part.

The Ap horizon has hue of 10YR through 5YR, value of 3, and chroma of 2 or 3. Texture is silt loam or silty clay loam.

The B1t horizon has hue of 5YR, value of 4, and chroma of 4 or 6. Texture is silt loam or silty clay loam.

The B21t horizon has hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 6. Texture is silty clay loam.

The B22t and B23t horizons have hue of 5YR through 10R, value of 3, and chroma of 6. Some pedons are mottled in shades of brown and gray. Texture is silty clay loam or silty clay.

Colors in the C horizon are similar to those in the B23t horizon, but most pedons are mottled in shades of brown and gray. Texture is silty clay or clay.

In this survey area, Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded, is considered a taxadjunct to the series because the Ap horizon has a color value too high to qualify as a mollic intergrade.

Ramsey series

The Ramsey series consists of shallow, somewhat excessively drained, rapidly permeable soils on uplands underlain by sandstone. These steep to very steep soils are on rough, irregular side slopes. The slope ranges from 20 to 40 percent.

Ramsey soils are on the same landscape with Frondorf soils. Frondorf soils have a fine-loamy control section and an argillic horizon, and they are 20 to 40 inches deep to bedrock.

Typical pedon of Ramsey loam in an area of Ramsey-Frondorf complex, 20 to 40 percent slopes, in a wooded area 1.1 miles east of the intersection of Kentucky Highways 1592 and 1037; 500 feet east of Shanty Hollow Lake, about 12 miles north of Bowling Green:

A1—0 to 1 inch; very dark grayish brown (10YR 3/2) loam; weak fine granular structure; very friable; many fine roots; very strongly acid; clear smooth boundary.

A2—1 to 4 inches; brown (10YR 4/3) channery loam; weak medium granular structure; very friable; many fine roots; few fine pores; 15 percent sandstone fragments up to 2 inches across; strongly acid; clear smooth boundary.

B2—4 to 12 inches; yellowish brown (10YR 5/4) channery loam; moderate medium subangular blocky structure; friable; common fine and medium roots; few fine pores; 20 percent sandstone fragments up to 2 inches across; very strongly acid; abrupt smooth boundary.

B3—12 to 20 inches; light yellowish brown (10YR 6/4) channery loam; moderate medium subangular blocky structure; friable; common fine and medium roots; common fine pores; 34 percent sandstone fragments up to 2 inches across; very strongly acid.

R—20 inches; acid sandstone bedrock.

Solum thickness and depth to sandstone bedrock range from 10 to 20 inches. The content of sandstone fragments ranges up to 35 percent in each horizon. Reaction ranges from strongly acid to very strongly acid.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Texture is loam or sandy loam. The A2 horizon has hue of 10YR, value of 4 through 6, and chroma of 3 or 4. Texture is loam or sandy loam or their channery analogues.

The B horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 or 6. Texture is loam or sandy loam or their channery analogues.

Robertsville series

The Robertsville series consists of deep, poorly drained, slowly permeable soils that have a fragipan. These nearly level soils formed in old alluvial or colluvial material. They are on broad, smooth uplands and stream terraces. They are water saturated in winter and early in spring. The slope ranges from 0 to 2 percent.

Robertsville soils are on the same landscape with Melvin, Newark, Lawrence, and Nicholson soils. Melvin and Newark soils do not have a fragipan. Lawrence and Nicholson soils are higher on the landscape and are better drained.

Typical pedon of Robertsville silt loam in a cultivated field 0.8 mile north of store at Plano on Kentucky Highway 622 to intersection of Sim Road; 5 miles west on Sim Road; 1,200 feet south of road, about 7 miles south of Bowling Green:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak fine granular structure; very friable; common fine roots; slightly acid; abrupt smooth boundary.

B2g—10 to 18 inches; light gray (10YR 7/1) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few small black concretions; very strongly acid; clear wavy boundary.

Bx—18 to 40 inches; gray (10YR 6/1) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure parting to weak fine and medium subangular blocky; very firm; brittle and compact; few thin clay films on prisms and few gray silt coatings; few small black concretions; very strongly acid; gradual wavy boundary.

Cg—40 to 70 inches; mottled gray (10YR 5/1), red (2.5YR 4/8), and yellowish red (5YR 5/8) silty clay; massive; very firm; few small black concretions; very strongly acid.

The solum thickness ranges from 40 to 60 inches. The depth to bedrock is more than 60 inches. In unlimed areas, the reaction ranges from strongly acid to very strongly acid from the surface layer through the fragipan. Below the fragipan, it ranges from very strongly acid to neutral.

The A horizon has hue of 10YR to 2.5Y, value of 4 to 6, and chroma of 1 or 2.

The B2 horizon has a texture of silt loam to silty clay loam. The hue is 10YR through 5Y, value is 6 or 7, and chroma is 1 or 2. This horizon is mottled in shades of brown, yellow, and gray.

The Bx horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 or 2. In some pedons, it is gray N 5/0 through N 7/0. It is mottled in shades of brown, yellow, and gray. Texture is silt loam or silty clay loam.

The C horizon has matrix and mottle colors of gray, red, and brown. Texture is dominantly silt loam, clay loam, or silty clay. In some pedons, it is loam, clay loam, or clay.

Sadler series

The Sadler series consists of deep, moderately well drained soils that have a slowly permeable fragipan. These soils are on broad ridgetops. They formed in a mantle of loess underlain by residuum of acid sandstone, siltstone, and shale. The slope ranges from 0 to 6 percent.

Sadler soils are on the same landscape with Wellston, Zanesville, and Lawrence soils. Wellston soils, which are on side slopes, are well drained and do not have a fragipan. Zanesville soils, which are adjacent to Sadler soils, do not have an A'&B horizon above the fragipan. The nearly level Lawrence soils, in concave areas, are somewhat poorly drained and have gray mottles in the upper 10 inches of the argillic horizon.

Typical pedon of Sadler silt loam, 0 to 2 percent slopes, in a pasture 2.2 miles northeast of the intersection of Kentucky Highway 263 and Threlkel Ferry Road in Richardsville; 0.2 mile northeast on farm road, and 300 feet west of farm road:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many fine roots; neutral; clear smooth boundary.

B2t—9 to 23 inches; brownish yellow (10YR 6/6) silty clay loam; few fine prominent mottles of strong brown (7.5YR 5/6); weak medium angular and subangular blocky structure; friable; many fine roots; common clay films; medium acid; abrupt smooth boundary.

A'&B—23 to 26 inches; brown (10YR 5/3) silt loam (A' material) as coatings 1 mm to 5 mm thick on brownish yellow (10YR 6/6) silty clay loam (B material) peds; by volume, about 45 percent of horizon is peds; moderate medium subangular blocky structure; friable; few fine roots; few fine black concretions; very strongly acid; clear smooth boundary.

IIBx—26 to 56 inches; mottled brownish yellow (10YR 6/6), grayish brown (10YR 5/2), and yellowish brown (10YR 5/4) silty clay loam; strong very coarse prismatic structure parting to moderate medium angular blocky; firm; compact and brittle; common clay films; few black and brown concretions; very strongly acid; clear smooth boundary.

IIB3—56 to 65 inches; light brownish gray (2.5Y 6/2) silt loam; common medium distinct mottles of yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8); moderate medium subangular blocky structure; firm; common clay films; few small sandstone fragments; few small black and brown concretions; very strongly acid.

IIR—65 inches; sandstone bedrock.

The solum thickness ranges from 40 to 70 inches. The depth to sandstone bedrock ranges from 50 to 100 inches. Depth to the fragipan ranges from 18 to 32 inches. Reaction is strongly acid to very strongly acid throughout, except where the surface layer has been limed.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 through 4. It is 5 to 10 inches thick.

The B2t horizon has hue of 7.5YR through 2.5Y, value of 5 or 6, and chroma of 4 through 6. It is 10 to 20 inches thick. Texture is silt loam or silty clay loam.

The A' material of the A'&B horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 2 or 3. The B material has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 through 8. It is 3 to 6 inches thick. Texture is silt loam or silty clay loam.

The IIBx horizon has hue of 7.5YR through 5Y, value of 5 or 6, and chroma of 2 through 6. It is 12 to 30 inches thick. The texture is silt loam or silty clay loam.

The IIB3 horizon has hue of 2.5Y, 10YR, and 7.5YR, value of 6 or 5, and chroma of 2 through 6. Texture is silt loam, silty clay loam, or clay loam and their channery analogues. The content of sandstone fragments ranges from 1 to 60 percent.

Wellston series

The Wellston series consists of deep, well drained, moderately permeable soils that formed in a mantle of loess and in material weathered from standstone and siltstone. The slope ranges from 2 to 12 percent.

Wellston soils are on the same landscape with Sadler, Zanesville, and Frondorf soils. The Sadler and Zanesville soils, which are on broad ridgetops, have a fragipan. The moderately deep Frondorf soils are on side slopes, and are channery below a depth of 15 inches.

Typical pedon of Wellston silt loam, in an area of Wellston silt loam, 2 to 6 percent slopes, in a wooded area 3.5 miles southwest of Bowling Green on U.S. Highway 68; 1.5 miles west on Kentucky Highway 1083;

1.3 miles north on paved road; 0.8 mile east on farm road; and 400 feet east of an oil well:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many fine roots; strongly acid; abrupt smooth boundary.
B1—8 to 13 inches; yellowish brown (10YR 5/6) silt loam; weak fine and medium subangular blocky structure; friable; many roots; few clay films; few black concretions; very strongly acid; clear smooth boundary.
B21—13 to 30 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common roots; few clay films; silt coating of pale brown (10YR 6/3) on faces of few peds; few black concretions; very strongly acid; abrupt smooth boundary.
IIB3—30 to 46 inches; strong brown (7.5YR 5/6) clay loam; moderate medium angular and subangular blocky structure; firm; few fine roots; 20 percent sandstone fragments in the lower part; very strongly acid; abrupt wavy boundary.
IIR—46 inches; fine grained sandstone.

Solum thickness ranges from 32 to 50 inches. The depth to bedrock ranges from 40 to 72 inches. The reaction in unlimed soil is medium acid to very strongly acid to a depth of 25 inches and very strongly acid to medium acid in the lower part of the solum. The content of coarse fragments ranges from none in the upper part of the B horizon to 60 percent in the IIB3t horizon.

The Ap horizon is 4 to 8 inches thick. It has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 through 4.

The B1 horizon is 4 to 9 inches thick. It has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 through 6.

The B2t horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 through 8. The texture is silt loam or silty clay loam.

The IIB3 horizon is 4 to 15 inches thick. It has hue of 7.5YR, value of 4 or 5, and chroma of 4 through 6. The texture is silt loam, silty clay loam, or clay loam and their channery analogues.

Zanesville series

The Zanesville series consists of deep, well drained to moderately well drained, moderately slowly permeable to slowly permeable soils. These soils formed in loess over residuum of sandstone or siltstone. They are on the upper part of side slopes and ridgetops. The slope ranges from 2 to 12 percent.

Zanesville soils are on the same landscape with Wellston, Frondorf, Sadler, and Lawrence soils. Wellston and Frondorf soils do not have a fragipan. Sadler soils have an A'&B horizon above the fragipan. The nearly level Lawrence soils, on concave uplands, have mottles with chroma of 2 or less in the upper 10 inches of the argillic horizon.

Typical pedon of Zanesville silt loam, 2 to 6 percent slopes, in a cultivated field 2.2 miles northwest of Richardsville on Kentucky Highway 263; 200 feet north on a private road; and 50 feet west of private road:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; very friable; many fine roots; mildly alkaline; clear smooth boundary.
B21t—8 to 16 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; many fine roots; medium acid; abrupt smooth boundary.
B22t—16 to 23 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; strongly acid; clear wavy boundary.
Bx1—23 to 35 inches; yellowish brown (10YR 5/6) silty clay loam; many medium distinct mottles of light brownish gray (10YR 6/2); moderate very coarse prismatic structure parting to moderate medium angular blocky; firm; compact and brittle; strongly acid; clear wavy boundary.
Bx2—35 to 45 inches; yellowish brown (10YR 5/6) silty clay loam; many fine medium distinct mottles of brown (10YR 5/3) and gray (10YR 6/1); moderate very coarse prismatic structure parting to moderate medium angular and subangular blocky; firm; compact and brittle; strongly acid; clear smooth boundary.
IIC—45 to 56 inches; yellowish brown (10YR 5/6) silty clay loam; common distinct mottles of gray (10YR 6/1) and light brownish gray (2.5Y 6/2); weak medium subangular blocky and platy structure; firm; 5 to 10 percent weathered sandstone fragments; very strongly acid.
IIR—56 inches; fine grained sandstone.

The solum thickness ranges from 36 to 56 inches, and depth to sandstone or shale bedrock ranges from 40 to 80 inches. The depth to the fragipan ranges from 23 to 32 inches. The content of coarse fragments ranges up to 5 percent in the Bx horizon and from 5 to 30 percent in the IIC horizon. Reaction ranges from strongly acid to very strongly acid, except where the surface layer has been limed.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2t horizon has hue of 7.5YR in the upper part and hue of 10YR in the lower part, value of 5, and chroma of 4 through 6. Texture is silt loam or silty clay loam.

The Bx horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 or 6. Texture is silt loam or silty clay loam. The mottles are in shades of brown or gray.

The IIC horizon has the same color range as the Bx horizon. Texture is silt loam, silty clay loam, or clay loam and their channery analogues.

formation of the soils

In this section the factors of soil formation are discussed and related to the soils in the survey area.

The characteristics of a soil at any given point depend on the physical and chemical composition of the parent material; the climate; the plant and animal life; relief; and time. Soil is formed by the interaction of these five factors. The relative importance of each factor differs from one area to another. Climate and plant and animal life are not likely to vary much over an area the size of one or two counties, but many local differences in soils may have been caused by differences in relief and parent material. Because the interrelationships among these five factors are complex, the effects of any one factor are difficult to determine.

parent material

In Warren County the soils developed from a variety of parent materials. Parent material is the unconsolidated mass of geologic material from which soils formed. Most of the soils in the survey area formed in residuum and to less extent in loess or alluvium.

The three kinds of parent materials of soils in Warren County are: (1) residual material that weathered in place; (2) colluvial material that washed or moved by gravity from hillsides and accumulated on foot slopes; and (3) alluvial material deposited by streams. A few soils on uplands formed partly in a mantle of loess over the material that weathered from the underlying rock.

The rock formations in Warren County represent the Mississippian and Pennsylvanian periods.

Most of the soils formed in material weathered from limestone, sandstone, siltstone, and shale. The soils that formed in material weathered from limestone are Pembroke, Baxter, and Caneyville soils, and those that formed in material weathered from sandstone, siltstone, and shale are Wellston, Frondorf, Zanesville, and Sadler soils. The soils that formed in alluvium or a mixture of alluvium and colluvium are Nolin, Lindside, Newark, and Melvin soils. These soils are scattered throughout the survey area.

climate

The temperate, humid climate of Warren County is probably similar to the climate during the period in which these soils formed. Warm temperatures and abundant rainfall permitted the soils to weather almost continuously.

Water moving downward through the soil leaches soluble substances and moves clay downward. Most of the upland soils in the survey area are acid because soluble bases were leached out.

The humid climate and favorable rainfall helped to develop a number of deeply weathered soils in the survey area, for example, Pembroke and Baxter soils. These soils have deep profile development and zones of accumulation of translocated clay. Rainfall and temperature also influence the growth, death, and decay of soil organisms and affect their other activities. These organisms, in turn, influence the formation of the soil profile.

plant and animal life

The decayed remains of plants and animals form organic matter, which is an integral part of the soil. The organic matter content affects friability and tilth of the soil. Soils developed under grasses or hardwoods vary in their organic matter content. The humid climate and abundant rainfall influenced the growth of mixed hardwood forest in the survey area. The early settlers cleared and farmed these areas, but the soils were influenced by formation under a hardwood forest. In the survey area, most of the soils have a moderate or low organic matter content and have a light-colored surface layer. Examples are Crider, Frondorf, Zanesville, and Sadler soils.

Insects, earthworms, rodents, protozoans, bacteria, fungi, and similar organisms exerted less influence than the plants on properties of the soils. The larger organisms channel through the soil material, mostly in the surface layer. Micro-organisms help to decompose organic matter.

The influence of man on the soils of the county has covered only a brief period, but man has altered the soils at a rapid rate since he first came to the area. He has mixed the surface layer and subsoil, has graded and leveled some areas, and has allowed much of the surface layer to be lost through erosion. Man's impact, however, has been restricted mainly to the surface layer and the upper part of the subsoil.

relief

Relief influences the formation of soils and is responsible for many of the differences in soils in the

county. In this county, relief ranges from nearly level to steep. Because of relief, the soils differ in drainage, runoff rate, rate of erosion, and amount of leaching, movement of soil particles in the profile, and depth to bedrock.

The nearly level soils in slightly depressed areas or areas lower than adjacent soils are not as well drained as the more sloping soils. Runoff is slow, and little or no soil has been lost through erosion. Examples of poorly drained or somewhat poorly drained soils in the county are Melvin, Lawrence, and Newark soils.

Soils that formed on steep hillsides are mostly in the northern part of the survey area. Most of the rainfall runs off these soils; little water infiltrates the soil and moves downward to cause leaching and translocation of clay. The Ramsey soils are an example. They are shallow to bedrock and have no accumulation of clay in the subsoil. In contrast, the less sloping Wellston soils, which formed on ridges and side slopes, are deep and have zones of clay accumulation.

time

Time is one of the most important factors of soil formation. The time required for a soil to form depends on the other soil-forming factors. Less time is needed for a soil to form in a temperate, moist climate than in a much colder climate.

The degree of profile development determines the age of a soil. For example, Pembroke, Crider, and Baxter soils have well-developed soil horizons and are classified as older soils than Nolin and Newark soils. Nolin and Newark soils are considered younger because they have indistinct soil horizons, and they are on flood plains where alluvium still accumulates.

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glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 40-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 2.4
Low	2.4 to 3.2
Moderate	3.2 to 5.2
High	More than 5.2

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only

after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent

material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-74 at Bowling Green, Kentucky]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	44.3	25.6	35.0	71	-7	10	4.59	2.11	6.61	7	3.4
February---	48.1	27.6	37.9	74	-1	18	4.07	2.14	5.63	7	2.7
March------	56.8	35.2	46.0	81	15	102	5.16	3.08	7.02	9	2.5
April------	69.2	45.5	57.4	87	27	238	4.24	2.71	5.62	8	.1
May--------	78.2	54.2	66.3	92	34	505	4.10	2.22	5.63	7	.0
June-------	86.0	62.7	74.4	98	47	732	4.53	2.39	6.28	7	.0
July-------	89.1	66.7	77.9	99	52	865	4.09	2.22	5.61	7	.0
August-----	88.3	65.1	76.7	100	52	828	3.10	1.78	4.17	5	.0
September--	82.6	58.2	70.4	97	39	612	2.67	.97	4.03	5	.0
October----	71.5	45.5	58.5	90	26	279	2.50	1.15	3.58	4	.0
November---	56.9	35.3	46.1	80	16	29	3.73	2.24	5.06	6	.5
December---	47.5	28.8	38.2	72	4	22	4.38	2.42	5.97	7	1.8
Yearly:											
Average--	68.2	45.9	57.1	---	---	---	---	---	---	---	---
Extreme--	---	---	---	101	-10	---	---	---	---	---	---
Total----	---	---	---	---	---	4,240	47.16	41.18	52.94	79	11.0

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-74 at Bowling Green, Kentucky]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 5	April 14	April 27
2 years in 10 later than--	March 31	April 10	April 22
5 years in 10 later than--	March 20	April 2	April 13
First freezing temperature in fall:			
1 year in 10 earlier than--	November 2	October 22	October 9
2 years in 10 earlier than--	November 5	October 26	October 14
5 years in 10 earlier than--	November 13	November 2	October 23

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-74 at Bowling Green, Kentucky]

Probability	Daily minimum temperature		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	219	199	175
8 years in 10	225	204	181
5 years in 10	237	214	192
2 years in 10	249	223	202
1 year in 10	256	228	208

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
BaB	Baxter cherty silt loam, 2 to 6 percent slopes	2,820	0.8
BaC	Baxter cherty silt loam, 6 to 12 percent slopes	40,710	11.6
BaD	Baxter cherty silt loam, 12 to 20 percent slopes	33,990	9.7
BaE	Baxter cherty silt loam, 20 to 30 percent slopes	4,840	1.4
BbC3	Baxter cherty silty clay loam, 6 to 12 percent slopes, severely eroded	2,430	0.7
BbD3	Baxter cherty silty clay loam, 12 to 20 percent slopes, severely eroded	750	0.2
CaB	Caneyville silt loam, 2 to 6 percent slopes	350	0.1
CaC	Caneyville silt loam, 6 to 12 percent slopes	1,090	0.3
CnC3	Caneyville silty clay, 6 to 12 percent slopes, severely eroded	390	0.1
CoD	Caneyville-Rock outcrop complex, 6 to 20 percent slopes	11,420	3.3
CoE	Caneyville-Rock outcrop complex, 20 to 35 percent slopes	19,100	5.5
CrB	Crider silt loam, 2 to 6 percent slopes	8,780	2.5
CrC	Crider silt loam, 6 to 12 percent slopes	2,700	0.8
Du	Dunning silty clay loam	690	0.2
ElB	Elk silt loam, 2 to 6 percent slopes	1,070	0.3
FeC	Fredonia silt loam, very rocky, 2 to 12 percent slopes	26,580	7.6
FnC	Fredonia-Urban land complex, 2 to 12 percent slopes	2,510	0.7
FrC	Frondorf silt loam, 6 to 12 percent slopes	8,780	2.5
FrD	Frondorf silt loam, 12 to 20 percent slopes	9,370	2.7
Gr	Grigsby sandy loam	680	0.2
HaB	Hammack silt loam, 2 to 6 percent slopes	4,730	1.4
La	Lawrence silt loam	5,000	1.4
Ld	Lindside silt loam	1,160	0.3
Me	Melvin silt loam	1,330	0.4
Ne	Newark silt loam	4,600	1.3
NhA	Nicholson silt loam, 0 to 2 percent slopes	660	0.2
NhB	Nicholson silt loam, 2 to 6 percent slopes	9,310	2.7
No	Nolin silt loam	15,300	4.4
PeA	Pembroke silt loam, 0 to 2 percent slopes	4,950	1.4
PeB	Pembroke silt loam, 2 to 6 percent slopes	53,180	15.2
PeC	Pembroke silt loam, 6 to 12 percent slopes	8,370	2.4
PfC3	Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded	2,410	0.7
PrB	Pembroke-Urban land complex, 2 to 6 percent slopes	5,360	1.5
PrC	Pembroke-Urban land complex, 6 to 12 percent slopes	540	0.2
Pt	Pits	210	0.1
RfE	Ramsey-Frondorf complex, 20 to 40 percent slopes	19,320	5.5
Ro	Robertsville silt loam	1,490	0.4
RxE	Rock outcrop-Caneyville complex, 20 to 40 percent slopes	6,420	1.8
SaA	Sadler silt loam, 0 to 2 percent slopes	560	0.2
SaB	Sadler silt loam, 2 to 6 percent slopes	2,680	0.8
WeB	Wellston silt loam, 2 to 6 percent slopes	860	0.2
WeC	Wellston silt loam, 6 to 12 percent slopes	1,980	0.6
ZaB	Zanesville silt loam, 2 to 6 percent slopes	13,640	3.9
ZaC	Zanesville silt loam, 6 to 12 percent slopes	6,330	1.8
	Total	349,440	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Tobacco	Corn	Wheat	Soybeans	Grass-legume hay	Pasture
	Lb	Bu	Bu	Bu	Ton	AUM*
BaB Baxter	3,000	100	45	35	4.5	9.0
BaC Baxter	2,600	90	40	35	4.5	9.0
BaD Baxter	1,600	75	30	25	3.5	7.0
BaE Baxter	---	---	---	---	---	4.0
BbC3 Baxter	1,600	75	30	25	3.5	7.0
BbD3 Baxter	---	---	---	---	3.0	6.0
CaB Caneyville	2,500	85	---	---	4.0	8.0
CaC Caneyville	2,200	70	---	---	3.5	7.0
CnC3 Caneyville	---	---	---	---	---	5.5
CoD Caneyville-Rock outcrop	---	---	---	---	---	---
CoE Caneyville-Rock outcrop	---	---	---	---	---	---
CrB Crider	3,400	125	50	50	5.0	10.0
CrC Crider	2,900	100	45	40	4.5	9.0
Du Dunning	---	120	---	45	4.0	8.0
ElB Elk	3,200	125	45	50	4.5	9.0
FeC Fredonia	2,500	90	35	35	3.5	7.0
FnC Fredonia-Urban land	---	---	---	---	---	---
FrC Frondorf	---	85	35	30	3.0	6.0
FrD Frondorf	---	80	30	25	2.5	5.0
Gr Grigsby	---	95	---	35	3.0	6.0
HaB Hammack	3,100	120	50	40	5	10.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Tobacco	Corn	Wheat	Soybeans	Grass-legume hay	Pasture
	Lb	Bu	Bu	Bu	Ton	AUM*
La: Lawrence	1,700	85	---	40	3.0	5.5
Ld: Lindside	---	125	45	45	3.5	7.0
Me: Melvin	---	80	---	35	3.5	7.0
Ne: Newark	2,500	100	45	40	4.5	8.5
NhA: Nicholson	2,500	125	40	45	3.5	6.5
NhB: Nicholson	3,000	130	40	45	3.5	6.5
No: Nolin	3,300	135	45	50	4.5	9.0
PeA: Pembroke	3,400	140	50	50	5.0	10.0
PeB: Pembroke	3,400	140	50	50	5.0	10.0
PeC: Pembroke	2,900	120	40	40	4.5	9.0
PfC3: Pembroke	2,500	90	35	35	4.0	8.0
PrB: Pembroke-Urban land	---	---	---	---	---	---
PrC: Pembroke-Urban land	---	---	---	---	---	---
Pt: Pits.						
RfE: Ramsey-Frondorf	---	---	---	---	---	---
Ro: Robertsville	---	70	---	30	3.0	5.5
RxE: Rock outcrop-Caneyville	---	---	---	---	---	---
SaA: Sadler	2,350	100	40	30	3.5	7.0
SaB: Sadler	2,550	105	40	40	3.5	7.0
WeB: Wellston	3,000	105	45	45	4.0	7.5
WeC: Wellston	2,800	100	40	40	4.0	7.5
ZaB: Zanesville	2,800	110	40	40	4.0	7.5
ZaC: Zanesville	2,550	85	35	35	3.5	7.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	22,090	---	---	---
II	102,890	97,070	5,820	---
III	76,240	69,220	7,020	---
IV	50,780	49,290	1,490	---
V	---	---	---	---
VI	43,980	32,560	---	11,420
VII	44,840	19,320	---	25,520
VIII	---	---	---	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
BaB, BaC----------- Baxter	2o	Slight	Slight	Slight	Severe	Northern red oak---- Yellow-poplar------- Shortleaf pine------	79 89 80	Eastern white pine, loblolly pine, shortleaf pine, black locust, yellow-poplar.
BaD, BaE----------- Baxter	2r	Moderate	Moderate	Slight	Severe	Northern red oak---- Yellow-poplar------- Shortleaf pine------	79 89 80	Eastern white pine, loblolly pine, shortleaf pine, black locust, yellow-poplar.
BbC3--------------- Baxter	3o	Slight	Slight	Slight	Moderate	Northern red oak---- Virginia pine------- Eastern redcedar----	65 65 35	Shortleaf pine, loblolly pine, eastern redcedar.
BbD3--------------- Baxter	3r	Moderate	Moderate	Slight	Moderate	Northern red oak---- Virginia pine------- Eastern redcedar----	65 65 35	Shortleaf pine, loblolly pine, eastern redcedar.
CaB, CaC----------- Caneyville	3c	Slight	Moderate	Moderate	Moderate	Northern red oak---- Yellow-poplar------- Eastern redcedar----	69 80 45	Eastern redcedar, Virginia pine, eastern white pine, loblolly pine.
CnC3--------------- Caneyville	4c	Moderate	Moderate	Severe	Slight	Northern red oak---- Eastern redcedar----	60 40	Eastern redcedar, Virginia pine, loblolly pine.
CoD:*								
Caneyville--------	3x	Severe	Severe	Moderate	Moderate	Northern red oak---- Yellow-poplar------- Eastern redcedar----	69 80 45	Eastern redcedar, Virginia pine, eastern white pine, loblolly pine.
Rock outcrop.								
CoE:*								
Caneyville-------- (north aspect)	2x	Severe	Severe	Moderate	Severe	Yellow-poplar------- Black oak-----------	90 80	Yellow-poplar, black walnut, Virginia pine.
CoE:*								
Caneyville-------- (south aspect)	3x	Severe	Severe	Severe	Moderate	Scarlet oak--------- Eastern redcedar----	69 45	Eastern redcedar, Virginia pine, eastern white pine, loblolly pine.
Rock outcrop.								
CrB, CrC----------- Crider	1o	Slight	Slight	Slight	Severe	Northern red oak---- Yellow-poplar------- Virginia pine------- Shortleaf pine------	88 97 78 80	Eastern white pine, yellow-poplar, black walnut, loblolly pine, white ash.
Du----------------- Dunning	1w	Slight	Severe	Severe	Severe	Pin oak------------- Sweetgum------------ Eastern cottonwood--	95 95 100	Loblolly pine, pin oak.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
ElB: Elk	2o	Slight	Slight	Slight	Severe	Northern red oak	80	Eastern white pine, yellow-poplar, black walnut, loblolly pine.
						Yellow-poplar	90	
						Shortleaf pine	80	
						Eastern white pine	90	
FeC: Fredonia	3c	Slight	Moderate	Slight	Moderate	Northern red oak	70	Virginia pine, eastern redcedar.
						Eastern redcedar	50	
FrC, FrD: Frondorf	2o	Slight	Slight	Slight	Severe	Northern red oak	77	Yellow-poplar, shortleaf pine, black walnut, eastern white pine, loblolly pine.
						White oak	---	
						Black oak	---	
Gr: Grigsby	2o	Slight	Slight	Slight	Severe	Yellow-poplar	94	Yellow-poplar, shortleaf pine, eastern cottonwood, American sycamore.
						Northern red oak	80	
HaB: Hammack	2o	Slight	Slight	Slight	Severe	Northern red oak	82	Yellow-poplar, black walnut, shortleaf pine, loblolly pine, Virginia pine.
						White oak	82	
						Yellow-poplar	92	
La: Lawrence	2w	Slight	Moderate	Slight	Severe	Northern red oak	65	Yellow-poplar, white ash, loblolly pine, American sycamore.
						Yellow-poplar	90	
						Sweetgum	87	
						Shortleaf pine	69	
Ld: Lindside	1o	Slight	Slight	Slight	Severe	Northern red oak	85	Eastern white pine, yellow-poplar.
						Yellow-poplar	95	
						Black walnut	---	
						White oak	85	
Me: Melvin	1w	Slight	Severe	Severe	Severe	Pin oak	101	Pin oak, American sycamore, sweetgum, loblolly pine.
						Sweetgum	92	
Ne: Newark	1w	Slight	Moderate	Slight	Severe	Pin oak	99	Eastern cottonwood, sweetgum, post oak, loblolly pine, red maple, American sycamore, eastern white pine, yellow-poplar.
						Eastern cottonwood	94	
						Northern red oak	85	
						Yellow-poplar	95	
						Sweetgum	88	
NhA, NhB: Nicholson	2o	Slight	Slight	Slight	Severe	Northern red oak	75	Black walnut, yellow-poplar, eastern white pine, shortleaf pine, white ash.
						Sweetgum	84	
No: Nolin	1o	Slight	Slight	Slight	Severe	Sweetgum	85	Sweetgum, yellow-poplar, eastern white pine, eastern cottonwood, white ash, cherrybark oak.
						Yellow-poplar	107	
PeA, PeB, PeC, PfC3: Pembroke	1o	Slight	Slight	Slight	Severe	Northern red oak	95	Yellow-poplar, black walnut, white ash, eastern white pine, loblolly pine.
						Yellow-poplar	90	
						Virginia pine	85	
						Shortleaf pine	85	
RfE:*								
Ramsey (north aspect)	3d	Severe	Severe	Severe	Moderate	White oak	71	Virginia pine, shortleaf pine, eastern white pine, loblolly pine.
						Virginia pine	66	
						Yellow-poplar	91	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
RfE:* Frondorf (north aspect)	2r	Moderate	Moderate	Slight	Severe	Northern red oak	77	Yellow-poplar, shortleaf pine, black walnut, eastern white pine, loblolly pine.
						White oak	---	
						Black oak	---	
						Yellow-poplar	---	
RfE:* Ramsey (south aspect)	4d	Severe	Severe	Severe	Slight	White oak	56	Virginia pine, shortleaf pine, eastern white pine, loblolly pine.
						Virginia pine	58	
						Scarlet oak	---	
Frondorf (south aspect)	3r	Moderate	Moderate	Moderate	Moderate	Black oak	70	Shortleaf pine, loblolly pine, Virginia pine.
						Scarlet oak	69	
Ro Robertsville	1w	Slight	Severe	Severe	Severe	Pin oak	94	Sweetgum, loblolly pine, American sycamore.
						Yellow-poplar	100	
						Sweetgum	93	
						Northern red oak	86	
RxE:* Rock outcrop.								
Caneyville (north aspect)	2x	Severe	Severe	Moderate	Severe	Yellow-poplar	90	Yellow-poplar, black walnut, Virginia pine.
						Black oak	80	
Caneyville (south aspect)	3x	Severe	Severe	Severe	Moderate	Scarlet oak	69	Eastern redcedar, Virginia pine, loblolly pine.
						Eastern redcedar	45	
SaA, SaB Sadler	3o	Slight	Slight	Slight	Moderate	Northern red oak	70	Eastern white pine, shortleaf pine, yellow-poplar, Virginia pine.
						Yellow-poplar	90	
						Virginia pine	70	
WeB, WeC Wellston	2o	Slight	Slight	Slight	Severe	Northern red oak	71	Eastern white pine, black walnut, yellow-poplar.
						Yellow-poplar	90	
						Virginia pine	70	
ZaB, ZaC Zanesville	3o	Slight	Slight	Slight	Moderate	Northern red oak	68	Virginia pine, eastern white pine, shortleaf pine.
						Virginia pine	64	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
BaB: Baxter	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, large stones.
BaC: Baxter	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, large stones, slope.
BaD: Baxter	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
BaE: Baxter	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
BbC3: Baxter	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, large stones, slope.
BbD3: Baxter	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
CaB: Caneyville	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, depth to rock, percs slowly.	Slight	Moderate: thin layer.
CaC: Caneyville	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.
CnC3: Caneyville	Severe: too clayey.	Severe: too clayey.	Severe: slope, too clayey.	Severe: too clayey, erodes easily.	Severe: too clayey.
CoD:*					
Caneyville	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.
Rock outcrop.					
CoE:*					
Caneyville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Rock outcrop.					
CrB: Crider	Slight	Slight	Moderate: slope.	Slight	Slight.
CrC: Crider	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Du: Dunning	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
ElB-------------------- Elk	Severe: floods.	Slight----------	Moderate: slope, floods.	Slight------------	Moderate: floods.
FeC-------------------- Fredonia	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: thin layer.
FnC:*					
Fredonia-------------	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: thin layer.
Urban land.					
FrC, FrD-------------- Frondorf	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope, thin layer.
Gr--------------------- Grigsby	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
HaB-------------------- Hammack	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
La--------------------- Lawrence	Severe: floods, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.
Ld--------------------- Lindside	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
Me--------------------- Melvin	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
Ne--------------------- Newark	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
NhA-------------------- Nicholson	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
NhB-------------------- Nicholson	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
No--------------------- Nolin	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: wetness.	Severe: floods.
PeA-------------------- Pembroke	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
PeB-------------------- Pembroke	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
PeC, PfC3------------- Pembroke	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.
PrB:*					
Pembroke-------------	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
Urban land.					
PrC:*					
Pembroke-------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
PrC:* Urban land.					
Pt:* Pits.					
RfE:*					
Ramsey	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, thin layer.
Frondorf	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ro Robertsville	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
RxE:* Rock outcrop.					
Caneyville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
SaA Sadler	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
SaB Sadler	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
WeB Wellston	Slight	Slight	Moderate: slope.	Slight	Slight.
WeC Wellston	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
ZaB Zanesville	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight	Slight.
ZaC Zanesville	Moderate: slope, percs slowly, wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Slight	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
BaB: Baxter	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BaC: Baxter	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BaD: Baxter	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BaE: Baxter	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BbC3: Baxter	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BbD3: Baxter	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CaB: Caneyville	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CaC, CnC3: Caneyville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CoD:*										
Caneyville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Rock outcrop.										
CoE:*										
Caneyville	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Rock outcrop.										
CrB: Crider	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CrC: Crider	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Du: Dunning	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
ElB: Elk	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
FeC: Fredonia	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
FnC:*										
Fredonia	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Urban land.										
FrC, FrD: Frondorf	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Gr: Grigsby	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
HaB----------------- Hammack	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
La----------------- Lawrence	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Ld----------------- Lindside	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Me----------------- Melvin	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Ne----------------- Newark	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
NhA----------------- Nicholson	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
NhB----------------- Nicholson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
No----------------- Nolin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PeA----------------- Pembroke	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PeB----------------- Pembroke	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PeC, PfC3----------- Pembroke	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
PrB:*										
Pembroke-----------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Urban land.										
PrC:*										
Pembroke-----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Urban land.										
Pt:* Pits.										
RfE:*										
Ramsey-------------	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Frondorf-----------	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Ro----------------- Robertsville	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
RxE:* Rock outcrop.										
Caneyville---------	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
SaA----------------- Sadler	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
SaB: Sadler	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WeB: Wellston	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WeC: Wellston	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ZaB: Zanesville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ZaC: Zanesville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
BaB: Baxter	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: small stones, large stones.
BaC: Baxter	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: small stones, large stones, slope.
BaD, BaE: Baxter	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
BbC3: Baxter	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: small stones, large stones, slope.
BbD3: Baxter	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
CaB: Caneyville	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength.	Moderate: thin layer.
CaC: Caneyville	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.
CnC3: Caneyville	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Severe: too clayey.
CoD:*						
Caneyville	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.
Rock outcrop.						
CoE:*						
Caneyville	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Rock outcrop.						
CrB: Crider	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
CrC: Crider	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Du: Dunning	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, wetness, floods.	Severe: wetness, floods.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
ElB-------------- Elk	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.	Moderate: floods.
FeC-------------- Fredonia	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength.	Moderate: thin layer.
FnC:*						
Fredonia---------	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength.	Moderate: thin layer.
Urban land.						
FrC, FrD--------- Frondorf	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.	Moderate: slope, thin layer.
Gr--------------- Grigsby	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
HaB-------------- Hammack	Moderate: too clayey.	Slight---------	Slight---------	Moderate: slope.	Severe: low strength.	Slight.
La--------------- Lawrence	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, floods.	Moderate: wetness, floods.
Ld--------------- Lindside	Severe: floods, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.
Me--------------- Melvin	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, wetness, floods.	Severe: wetness, floods.
Ne--------------- Newark	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, wetness, floods.	Severe: wetness, floods.
NhA-------------- Nicholson	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength.	Moderate: wetness.
NhB-------------- Nicholson	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: low strength.	Moderate: wetness.
No--------------- Nolin	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.	Severe: floods.
PeA-------------- Pembroke	Moderate: too clayey.	Slight---------	Moderate: shrink-swell.	Slight---------	Severe: low strength.	Slight.
PeB-------------- Pembroke	Moderate: too clayey.	Slight---------	Moderate: shrink-swell.	Moderate: slope.	Severe: low strength.	Slight.
PeC, PfC3-------- Pembroke	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
PrB:*						
Pembroke---------	Moderate: too clayey.	Slight---------	Moderate: shrink-swell.	Moderate: slope.	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
PrB:*						
Urban land.						
PrC:*						
Pembroke	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Urban land.						
Pt:*						
Pits.						
RfE:*						
Ramsey	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
Frondorf	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ro Robertsville	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, wetness, floods.	Severe: wetness.
RxE:*						
Rock outcrop.						
Caneyville	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
SaA Sadler	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: low strength, wetness.	Moderate: wetness.
SaB Sadler	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: low strength, wetness.	Moderate: wetness.
WeB Wellston	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength.	Slight.
WeC Wellston	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: low strength, slope.	Moderate: slope.
ZaB Zanesville	Moderate: depth to rock, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Moderate: low strength.	Slight.
ZaC Zanesville	Moderate: slope, wetness, depth to rock.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Moderate: low strength, slope.	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BaB: Baxter	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack, small stones.
BaC: Baxter	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack, small stones.
BaD, BaE: Baxter	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, small stones.
BbC3: Baxter	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack, small stones.
BbD3: Baxter	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, small stones.
CaB: Caneyville	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
CaC, CnC3: Caneyville	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
CoD:*					
Caneyville	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Rock outcrop.					
CoE:*					
Caneyville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Rock outcrop.					
CrB: Crider	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
CrC: Crider	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Du: Dunning	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, hard to pack, wetness.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
ElB: Elk	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
FeC: Fredonia	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
FnC:*					
Fredonia	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Urban land.					
FrC, FrD: Frondorf	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
Gr: Grigsby	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage, wetness.	Severe: floods, seepage.	Good.
HaB: Hammack	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, thin layer.
La: Lawrence	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Ld: Lindside	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
Me: Melvin	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Ne: Newark	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
NhA, NhB: Nicholson	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
No: Nolin	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
PeA: Pembroke	Slight	Moderate: seepage.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
PeB: Pembroke	Slight	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
PeC, PfC3: Pembroke	Moderate: slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
PrB:*					
Pembroke	Slight	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Urban land.					
PrC:*					
Pembroke	Moderate: slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Urban land.					
Pt:* Pits.					
RfE:*					
Ramsey	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, slope.
Frondorf	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Ro Robertsville	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
RxE:*					
Rock outcrop.					
Caneyville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
SaA, SaB Sadler	Severe: wetness, percs slowly.	Severe: wetness.	Severe: depth to rock, wetness.	Moderate: depth to rock, wetness.	Fair: area reclaim, too clayey, small stones.
WeB Wellston	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim, small stones.
WeC Wellston	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: area reclaim, small stones, slope.
ZaB Zanesville	Severe: percs slowly, wetness.	Severe: wetness.	Severe: depth to rock.	Moderate: depth to rock, wetness.	Fair: too clayey, area reclaim.
ZaC Zanesville	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: depth to rock.	Moderate: depth to rock, slope, wetness.	Fair: slope, too clayey, area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
BaB, BaC: Baxter	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
BaD: Baxter	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
BaE: Baxter	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
BbC3: Baxter	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
BbD3: Baxter	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
CaB, CaC, CnC3: Caneyville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CoD:*				
Caneyville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Rock outcrop.				
CoE:*				
Caneyville	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Rock outcrop.				
CrB: Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
CrC: Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
Du: Dunning	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
ElB: Elk	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
FeC: Fredonia	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
FnC:*				
Fredonia	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Urban land.				
FrC, FrD Frondorf	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Gr Grigsby	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
HaB Hammack	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
La Lawrence	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ld Lindside	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Me Melvin	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ne Newark	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
NhA, NhB Nicholson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
No Nolin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
PeA, PeB Pembroke	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
PeC, PfC3 Pembroke	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
PrB:*				
Pembroke	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Urban land.				
PrC:*				
Pembroke	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Urban land.				
Pt:* Pits.				
RfE:*				
Ramsey	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Frondorf	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
Ro------------------- Robertsville	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
RxE:*				
Rock outcrop.				
Caneyville-----------	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
SaA, SaB-------------- Sadler	Fair: area reclaim, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
WeB, WeC-------------- Wellston	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
ZaB, ZaC-------------- Zanesville	Fair: area reclaim, thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes and levees	Features affecting-- Drainage	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
BaB: Baxter	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable	Favorable.
BaC, BaD, BbC3, BbD3: Baxter	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Slope	Slope.
BaE: Baxter	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope	Slope.
CaB: Caneyville	Moderate: depth to rock.	Severe: thin layer, hard to pack.	Deep to water	Depth to rock, erodes easily.	Depth to rock, erodes easily.
CaC: Caneyville	Moderate: depth to rock.	Severe: thin layer, hard to pack.	Deep to water	Slope, depth to rock, erodes easily.	Slope, depth to rock, erodes easily.
CnC3: Caneyville	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
CoD,* CoE:* Caneyville	Severe: slope.	Severe: thin layer, hard to pack.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
Rock outcrop.					
CrB: Crider	Moderate: seepage, slope.	Severe: piping.	Deep to water	Favorable	Favorable.
CrC: Crider	Moderate: seepage.	Severe: piping.	Deep to water	Slope	Slope.
Du: Dunning	Slight	Severe: wetness.	Percs slowly, floods.	Wetness, percs slowly.	Wetness, percs slowly.
ElB: Elk	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
FeC: Fredonia	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Depth to rock, erodes easily.	Erodes easily, depth to rock.
FnC:* Fredonia	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Urban land.					
FrC, FrD: Frondorf	Moderate: depth to rock.	Severe: piping.	Deep to water	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Gr: Grigsby	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
HaB: Hammack	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
La-----Lawrence	Slight	Severe: piping, wetness.	Percs slowly, floods.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
Ld-----Lindside	Moderate: seepage.	Severe: piping, wetness.	Floods	Not needed	Favorable.
Me-----Melvin	Moderate: seepage.	Severe: piping, wetness.	Floods	Erodes easily, wetness.	Wetness, erodes easily.
Ne-----Newark	Moderate: seepage.	Severe: piping, wetness.	Floods	Erodes easily, wetness.	Wetness, erodes easily.
NhA-----Nicholson	Slight	Moderate: hard to pack, wetness.	Percs slowly	Erodes easily, wetness.	Erodes easily, rooting depth.
NhB-----Nicholson	Slight	Moderate: hard to pack, wetness.	Percs slowly, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
No-----Nolin	Severe: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily.
PeA-----Pembroke	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable	Favorable.
PeB-----Pembroke	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable	Favorable.
PeC, PfC3-----Pembroke	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Slope	Slope.
PrB:*					
Pembroke	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable	Favorable.
Urban land.					
PrC:*					
Pembroke	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Slope	Slope.
Urban land.					
Pt:* Pits.					
RfE:*					
Ramsey	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, droughty, depth to rock.
Frondorf	Severe: slope.	Severe: piping.	Deep to water	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Ro-----Robertsville	Moderate: seepage.	Severe: piping, wetness.	Percs slowly, floods.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
RxE:* Rock outcrop.					

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
RxE:* Caneyville	Severe: slope.	Severe: thin layer, hard to pack.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
SaA Sadler	Moderate: seepage, depth to rock.	Severe: piping.	Percs slowly	Erodes easily, wetness.	Erodes easily, rooting depth.
SaB Sadler	Moderate: seepage, depth to rock.	Severe: piping.	Percs slowly, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
WeB Wellston	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Erodes easily	Erodes easily.
WeC Wellston	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
ZaB Zanesville	Moderate: seepage, depth to rock.	Severe: piping.	Percs slowly, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
ZaC Zanesville	Moderate: seepage, depth to rock.	Severe: piping.	Percs slowly, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
BaB, BaC, BaD, BaE: Baxter	0-8	Cherty silt loam	ML, GM, CL-ML, GM-GC	A-4	0-10	60-90	55-80	45-70	45-70	25-35	4-10
	8-15	Cherty silty clay loam, cherty silt loam.	CL, GM-GC, GC, CL-ML	A-4, A-6	0-10	60-90	55-80	55-80	45-80	25-40	5-20
	15-88	Cherty silty clay, cherty clay.	CH, CL, GC	A-7	0-10	55-90	45-85	45-85	45-80	40-60	20-35
BbC3, BbD3: Baxter	0-3	Cherty silty clay loam.	CL	A-6	0-10	60-85	55-75	55-75	55-75	30-40	15-22
	3-13	Cherty silty clay loam, cherty silt loam.	CL, GM-GC, GC, CL-ML	A-4, A-6	0-10	60-90	55-80	55-80	45-80	25-40	5-20
	13-88	Cherty silty clay, cherty clay.	CH, CL, GC	A-7	0-10	55-90	45-85	45-85	45-80	40-60	20-35
CaB, CaC: Caneyville	0-6	Silt loam	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	6-11	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	11-27	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CnC3: Caneyville	0-3	Silty clay	CH, CL	A-7	0-3	90-100	85-100	80-100	75-100	45-65	25-45
	3-22	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CoD:* Caneyville	0-6	Silt loam	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	6-11	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	11-27	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
CoE:* Caneyville	0-6	Silt loam	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	6-11	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	11-27	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
CrB, CrC: Crider	0-9	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	85-100	25-35	4-12
	9-28	Silt loam, silty clay loam.	CL, ML, CL-ML	A-7, A-6, A-4	0	100	95-100	90-100	85-100	25-42	4-20
	28-70	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0-5	85-100	75-100	70-100	60-100	35-65	15-40
Du: Dunning	0-16	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	85-95	34-42	15-22
	16-65	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	95-100	95-100	90-100	85-100	45-70	20-40

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
ElB-------------- Elk	0-10	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	70-95	25-35	3-10
	10-42	Silty clay loam, silt loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	75-100	25-40	5-15
	42-65	Silty clay loam, silt loam.	ML, CL, CL-ML, SM-SC	A-4, A-6	0	75-100	50-100	45-100	40-95	25-40	5-15
FeC-------------- Fredonia	0-5	Silt loam--------	CL	A-6, A-4	0-5	95-100	90-100	85-100	75-100	25-40	8-20
	5-37	Silty clay, clay	CH, MH, CL	A-7	0-5	95-100	90-100	85-100	80-100	45-75	20-45
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
FnC:*											
Fredonia--------	0-6	Silt loam--------	CL	A-6, A-4	0-5	95-100	90-100	85-100	75-100	25-40	8-20
	6-37	Silty clay, clay	CH, MH, CL	A-7	0-5	95-100	90-100	85-100	80-100	45-75	20-45
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land.											
FrC, FrD--------- Frondorf	0-18	Silt loam--------	ML, CL, CL-ML	A-4	0-5	90-100	90-100	85-100	75-100	25-35	5-10
	18-26	Channery silty clay loam, channery silt loam, channery loam.	ML, CL, GM, GC	A-4, A-6, A-2, A-7	10-40	55-90	50-85	40-80	30-75	<45	NP-25
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gr--------------- Grigsby	0-7	Sandy loam-------	ML, CL-ML, SM, SM-SC	A-4	0	100	85-100	70-85	40-55	<20	NP-5
	7-40	Fine sandy loam, loam, sandy loam.	ML, CL-ML, SM, SM-SC	A-4	0	100	85-100	70-90	40-75	<20	NP-5
	40-60	Fine sandy loam, loam, sandy clay loam.	ML, CL-ML, SM, SM-SC	A-4	0	100	85-100	70-90	40-75	<20	NP-5
HaB-------------- Hammack	0-9	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-100	25-35	4-10
	9-30	Silt loam, silty clay loam.	ML, CL	A-6, A-7, A-4	0	100	95-100	90-100	85-95	30-45	6-20
	30-41	Very cherty silt loam, very cherty silty clay loam.	GM, GC, ML, CL	A-6, A-7, A-4, A-2	15-35	25-80	22-75	22-75	18-70	30-45	6-20
	41-84	Very cherty silty clay, very cherty clay, cherty clay.	GC, CL, CH	A-7, A-2	10-40	40-75	30-75	30-70	25-70	45-70	20-40
La--------------- Lawrence	0-7	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	80-100	25-35	2-10
	7-18	Silty clay loam, silt loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	95-100	90-100	80-100	25-42	5-20
	18-60	Silty clay loam, silt loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	95-100	90-100	80-100	25-42	5-20
Ld--------------- Lindside	0-42	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-90	25-40	2-15
	42-65	Silty clay loam, silt loam.	CL, ML, CL-ML	A-4, A-6	0	100	95-100	80-100	55-95	25-40	2-20
Me--------------- Melvin	0-9	Silt loam--------	CL, CL-ML, ML	A-4	0	95-100	90-100	80-100	80-95	25-35	4-10
	9-62	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	80-95	25-40	5-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ne------------- Newark	0-11	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	90-100	80-100	55-95	<32	NP-10
	11-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	95-100	90-100	85-100	70-95	22-42	3-20
NhA, NhB--------- Nicholson	0-6	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	80-95	25-35	5-10
	6-25	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	95-100	85-100	80-100	25-45	5-20
	25-37	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	90-100	80-100	75-95	25-45	5-20
	37-62	Silty clay, clay, channery clay.	CH, CL	A-7, A-6	0-10	80-100	70-100	60-100	55-95	38-70	16-40
No------------- Nolin	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	5-18
	9-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	75-100	25-46	5-23
PeA, PeB, PeC---- Pembroke	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	70-100	25-40	3-16
	9-33	Silty clay loam	CL	A-6, A-7	0	95-100	90-100	85-100	75-100	30-45	11-25
	33-75	Silty clay loam, silty clay.	CH, CL	A-7, A-6	0	90-100	75-100	75-100	65-100	35-65	20-45
	75-80	Silty clay, clay	CH, CL	A-7	0	85-100	75-100	70-100	60-95	45-70	20-45
PfC3------------ Pembroke	0-5	Silty clay loam	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	70-100	25-40	5-20
	5-26	Silty clay loam	CL	A-6, A-7	0	95-100	90-100	85-100	75-100	30-45	11-25
	26-66	Silty clay loam, silty clay.	CH, CL	A-7, A-6	0	90-100	75-100	75-100	65-100	35-65	20-45
	66-80	Silty clay, clay	CH, CL	A-7	0	85-100	75-100	70-100	60-95	45-70	20-45
PrB,* PrC:*											
Pembroke--------	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	70-100	25-40	3-16
	9-33	Silty clay loam	CL	A-6, A-7	0	95-100	90-100	85-100	75-100	30-45	11-25
	33-75	Silty clay loam, silty clay.	CH, CL	A-7, A-6	0	90-100	75-100	75-100	65-100	35-65	20-45
	75-80	Silty clay, clay	CH, CL	A-7	0	85-100	75-100	70-100	60-95	45-70	20-45
Urban land.											
Pt:* Pits.											
RfE:*											
Ramsey----------	0-20	Loam------------	SM, CL-ML, ML, CL	A-4, A-2	0-10	85-100	75-95	60-75	34-70	15-25	2-8
	20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Frondorf--------	0-18	Silt loam--------	ML, CL, CL-ML	A-4	0-5	90-100	90-100	85-100	75-100	25-35	5-10
	18-26	Channery silty clay loam, channery silt loam, channery loam.	ML, CL, GM, GC	A-4, A-6, A-2, A-7	10-40	55-90	50-85	40-80	30-75	<45	NP-25
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ro------------- Robertsville	0-10	Silt loam--------	ML	A-4	0	95-100	95-100	85-100	75-100	25-35	2-10
	10-18	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	3-20
	18-40	Silty clay loam, silt loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	3-20
	40-70	Silty clay loam, silty clay, silt loam.	CL, CH, CL-ML	A-6, A-7, A-4	0-5	80-100	75-100	70-100	60-100	25-60	5-35

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RxE:*											
Rock outcrop.											
Caneyville------	0-6	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	6-11	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	11-27	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SaA, SaB--------- Sadler	0-9	Silt loam--------	ML, CL-ML	A-4	0	95-100	95-100	85-100	80-100	25-35	4-10
	9-26	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	75-100	25-40	5-20
	26-56	Silt loam, silty clay loam, loam.	ML, CL, CL-ML	A-4, A-6	0-10	85-100	80-100	70-100	55-95	20-40	2-20
	56-65	Loam, silty clay loam, gravelly loam, silt loam.	ML, CL, SM, GM	A-4, A-6, A-7	0-20	65-100	60-95	50-95	36-90	20-50	2-30
WeB, WeC--------- Wellston	0-8	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	8-30	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	30-46	Silt loam, loam, gravelly loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	46	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ZaB, ZaC--------- Zanesville	0-8	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	8-23	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	23-45	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	45-56	Sandy clay loam, clay loam, silty clay loam, channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2, A-1-B	0-10	65-100	50-95	40-95	20-85	20-40	2-20
	56	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
						K	T
	In	In/hr	In/in	pH			
BaB, BaC, BaD,							
BaE	0-8	0.6-2.0	0.14-0.18	4.5-6.5	Low	0.32	4
Baxter	8-15	0.6-2.0	0.14-0.18	4.5-5.5	Moderate	0.24	
	15-88	0.6-2.0	0.10-0.14	4.5-5.5	Moderate	0.24	
BbC3, BbD3	0-3	0.6-2.0	0.12-0.18	4.5-6.5	Low	0.32	4
Baxter	3-10	0.6-2.0	0.14-0.18	4.5-5.5	Moderate	0.24	
	10-88	0.6-2.0	0.10-0.14	4.5-5.5	Moderate	0.24	
CaB, CaC	0-6	0.6-2.0	0.15-0.22	5-1-6.0	Low	0.43	3
Caneyville	6-11	0.2-0.6	0.12-0.18	5.1-6.0	Moderate	0.28	
	11-27	0.2-0.6	0.12-0.18	5.6-7.3	Moderate	0.28	
	27	---	---	---	---------------	----	
CnC3	0-3	0.2-0.6	0.13-0.18	5.1-6.0	Moderate	0.43	2
Caneyville	3-22	0.2-0.6	0.12-0.18	5.1-7.3	Moderate	0.28	
	22	---	---	---	---------------	----	
CoD:*							
Caneyville	0-6	0.6-2.0	0.15-0.22	5.1-6.0	Low	0.43	3
	6-11	0.2-0.6	0.12-0.18	5.1-6.0	Moderate	0.28	
	11-27	0.2-0.6	0.12-0.18	5.6-7.3	Moderate	0.28	
	27	---	---	---	---------------	----	
Rock outcrop.							
CoE:*							
Caneyville	0-6	0.6-2.0	0.15-0.22	5.1-6.0	Low	0.43	3
	6-11	0.2-0.6	0.12-0.18	5.1-6.0	Moderate	0.28	
	11-27	0.2-0.6	0.12-0.18	5.6-7.3	Moderate	0.28	
	27	---	---	---	---------------	----	
Rock outcrop.							
CrB, CrC	0-9	0.6-2.0	0.19-0.23	5.1-7.3	Low	0.32	4
Crider	9-28	0.6-2.0	0.18-0.23	5.1-7.3	Low	0.28	
	28-70	0.6-2.0	0.12-0.18	4.5-6.0	Moderate	0.28	
Du	0-16	0.6-2.0	0.19-0.23	6.1-7.8	Moderate	0.28	5
Dunning	16-65	0.06-0.2	0.14-0.18	6.1-7.8	Moderate	0.28	
ElB	0-10	0.6-2.0	0.19-0.23	5.1-6.5	Low	0.32	4
Elk	10-42	0.6-2.0	0.18-0.22	5.1-6.0	Low	0.28	
	42-65	0.6-2.0	0.14-0.20	5.1-6.0	Low	0.28	
FeC	0-5	0.6-2.0	0.18-0.22	5.1-6.0	Low	0.37	3
Fredonia	5-37	0.06-0.6	0.13-0.18	5.1-7.3	Moderate	0.28	
	37	---	---	---	---------------	----	
FnC:*							
Fredonia	0-6	0.6-2.0	0.18-0.22	5.1-6.0	Low	0.37	3
	6-32	0.06-0.6	0.13-0.18	5.1-7.3	Moderate	0.28	
	32	---	---	---	---------------	----	
Urban land.							
FrC, FrD	0-18	0.6-2.0	0.18-0.22	4.5-5.5	Low	0.32	3
Frondorf	18-26	0.6-2.0	0.08-0.16	4.5-5.5	Low	0.17	
	26	---	---	---	---------------	----	
Gr	0-7	2.0-6.0	0.14-0.18	5.6-7.3	Low	0.32	5
Grigsby	7-40	2.0-6.0	0.12-0.16	5.6-7.3	Low	0.32	
	40-60	2.0-6.0	0.12-0.16	5.6-7.3	Low	0.32	

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T
	In	In/hr	In/in	pH			
HaB--------------	0-9	0.6-2.0	0.19-0.23	5.1-7.3	Low------------	0.32	4
Hammack	9-30	0.6-2.0	0.18-0.23	5.1-7.3	Low------------	0.32	
	30-41	0.6-2.0	0.05-0.10	5.1-7.3	Low------------	0.24	
	41-84	0.6-2.0	0.08-0.12	5.1-7.3	Moderate--------	0.24	
La---------------	0-7	0.6-2.0	0.19-0.23	4.5-5.5	Low------------	0.43	3
Lawrence	7-18	0.6-2.0	0.18-0.22	4.5-5.5	Low------------	0.37	
	18-60	0.06-0.2	0.08-0.12	4.5-5.5	Low------------	0.43	
Ld---------------	0-42	0.6-2.0	0.20-0.26	5.6-7.3	Low------------	0.28	3
Lindside	42-65	0.6-2.0	0.17-0.22	5.6-7.3	Low------------	0.28	
Me---------------	0-9	0.6-2.0	0.18-0.23	6.1-7.8	Low------------	0.43	5
Melvin	9-62	0.6-2.0	0.18-0.23	6.1-7.8	Low------------	0.43	
Ne---------------	0-11	0.6-2.0	0.15-0.23	5.6-7.8	Low------------	0.43	5
Newark	11-60	0.6-2.0	0.18-0.23	5.6-7.8	Low------------	0.43	
NhA, NhB---------	0-6	0.6-2.0	0.19-0.23	5.1-6.5	Low------------	0.43	3
Nicholson	6-25	0.6-2.0	0.18-0.22	5.1-6.5	Low------------	0.43	
	25-37	0.06-0.2	0.07-0.12	5.1-6.5	Low------------	0.43	
	37-62	0.06-0.6	0.07-0.12	5.1-6.5	Moderate--------	0.37	
No---------------	0-9	0.6-2.0	0.18-0.23	5.6-7.3	Low------------	0.43	5
Nolin	9-60	0.6-2.0	0.18-0.23	5.6-7.3	Low------------	0.43	
PeA, PeB, PeC----	0-9	0.6-2.0	0.18-0.23	4.5-7.3	Low------------	0.32	4
Pembroke	9-33	0.6-2.0	0.18-0.22	4.5-6.0	Low------------	0.28	
	33-75	0.6-2.0	0.13-0.19	4.5-6.0	Moderate--------	0.28	
	75-80	0.6-2.0	0.12-0.17	4.5-6.0	Moderate--------	0.28	
PfC3-------------	0-5	0.6-2.0	0.18-0.22	4.5-7.3	Low------------	0.32	3
Pembroke	5-26	0.6-2.0	0.18-0.22	4.5-6.0	Low------------	0.28	
	26-66	0.6-2.0	0.13-0.19	4.5-6.0	Moderate--------	0.28	
	66-80	0.6-2.0	0.12-0.17	4.5-6.0	Moderate--------	0.28	
PrB,* PrC:*							
Pembroke---------	0-9	0.6-2.0	0.18-0.23	4.5-7.3	Low------------	0.32	4
	9-33	0.6-2.0	0.18-0.22	4.5-6.0	Low------------	0.28	
	33-75	0.6-2.0	0.13-0.19	4.5-6.0	Moderate--------	0.28	
	75-80	0.6-2.0	0.12-0.17	4.5-6.0	Moderate--------	0.28	
Urban land.							
Pt:*							
Pits.							
RfE:*							
Ramsey-----------	0-19	6.0-20	0.09-0.12	4.5-5.5	Low------------	0.17	1
	19	---	---	---	---------------	----	
Frondorf---------	0-18	0.6-2.0	0.18-0.22	4.5-5.5	Low------------	0.32	3
	18-26	0.6-2.0	0.08-0.16	4.5-5.5	Low------------	0.17	
	26	---	---	---	---------------	----	
Ro---------------	0-10	0.6-2.0	0.19-0.23	5.1-6.5	Low------------	0.43	3
Robertsville	10-18	0.6-2.0	0.18-0.22	4.5-5.5	Low------------	0.43	
	18-40	0.06-0.2	0.08-0.12	4.5-5.5	Low------------	0.43	
	40-70	0.2-0.6	0.08-0.12	4.5-7.3	Low------------	0.37	
RxE:*							
Rock outcrop.							
Caneyville-------	0-6	0.6-2.0	0.15-0.22	5.1-6.0	Low------------	0.43	3
	6-11	0.2-0.6	0.12-0.18	5.1-6.0	Moderate--------	0.28	
	11-27	0.2-0.6	0.12-0.18	5.6-7.3	Moderate--------	0.28	
	27	---	---	---	---------------	----	

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
						K	T
	In	In/hr	In/in	pH			
SaA, SaB--------- Sadler	0-9	0.6-2.0	0.19-0.23	4.5-7.3	Low------------	0.43	3
	9-26	0.6-2.0	0.18-0.22	4.5-5.5	Low------------	0.43	
	26-56	0.06-0.2	0.07-0.12	4.5-5.5	Low------------	0.43	
	56-65	0.2-2.0	0.07-0.12	4.5-5.5	Low------------	0.43	
WeB, WeC--------- Wellston	0-8	0.6-2.0	0.18-0.22	5.1-6.5	Low------------	0.37	4
	8-30	0.6-2.0	0.17-0.21	4.5-6.0	Low------------	0.37	
	30-46	0.6-2.0	0.12-0.17	4.5-6.0	Low------------	0.37	
	46	---	---	---	---------------	----	
ZaB, ZaC--------- Zanesville	0-8	0.6-2.0	0.19-0.23	4.5-5.5	Low------------	0.37	3
	8-23	0.6-2.0	0.17-0.22	4.5-5.5	Low------------	0.37	
	23-45	0.06-0.6	0.08-0.12	4.5-5.5	Low------------	0.37	
	45-56	0.2-2.0	0.08-0.12	4.5-5.5	Low------------	0.28	
	56	---	---	---	---------------	----	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
BaB, BaC, BaD, BaE, BbC3, BbD3: Baxter	B	None	---	---	>6.0	---	---	>60	---	High	High.
CaB, CaC, CnC3: Caneyville	C	None	---	---	>6.0	---	---	20-40	Hard	High	Moderate.
CoD,* CoE:* Caneyville	C	None	---	---	>6.0	---	---	20-40	Hard	High	Moderate.
Rock outcrop.											
CrB, CrC: Crider	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Du: Dunning	D	Frequent	Brief	Dec-May	0-0.5	Apparent	Jan-Apr	>60	---	High	Moderate.
ElB: Elk	B	Occasional	Brief	Jan-Apr	>6.0	---	---	>60	---	Moderate	Moderate.
FeC: Fredonia	C	None	---	---	>6.0	---	---	20-40	Hard	High	Moderate.
FnC:* Fredonia	C	None	---	---	>6.0	---	---	20-40	Hard	High	Moderate.
Urban land.											
FrC, FrD: Frondorf	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High.
Gr: Grigsby	B	Frequent	Brief	Dec-May	4.0-6.0	Apparent	Jan-Apr	>60	---	Low	Moderate.
HaB: Hammack	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
La: Lawrence	C	Occasional	Very brief	Dec-Apr	1.0-2.0	Perched	Dec-Apr	>60	---	High	High.
Ld: Lindside	C	Frequent	Very brief	Dec-May	1.5-3.0	Apparent	Dec-Apr	>60	---	Moderate	Low.
Me: Melvin	D	Frequent	Brief	Dec-May	0-1.0	Apparent	Dec-May	>60	---	High	Low.
Ne: Newark	C	Frequent	Brief	Dec-May	0.5-1.5	Apparent	Dec-May	>60	---	High	Low.
NhA, NhB: Nicholson	C	None	---	---	1.5-2.5	Perched	Jan-Apr	>60	---	High	Moderate.
No: Nolin	B	Frequent	Brief to long.	Dec-May	>6.0	---	---	>60	---	Low	Moderate.
PeA, PeB, PeC, PfC3: Pembroke	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
PrB,* PrC:* Pembroke	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Urban land.											

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
Pt:*											
Pits.											
RfE:*											
Ramsey-----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Moderate.
Frondorf---------	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	High.
Ro---------------- Robertsville	D	Occasional	Brief-----	Dec-May	0-1.0	Perched	Jan-Apr	>60	---	High-----	High.
RxE:*											
Rock outcrop.											
Caneyville-------	C	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
SaA, SaB---------- Sadler	C	None--------	---	---	1.5-2.0	Perched	Jan-Apr	>50	Hard	Moderate	High.
WeB, WeC---------- Wellston	B	None--------	---	---	>6.0	---	---	>40	Hard	Moderate	High.
ZaB, ZaC---------- Zanesville	C	None--------	---	---	2.0-3.0	Perched	Jan-Apr	>40	Hard	Moderate	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Baxter	Fine, mixed, mesic Typic Paleudalfs
Caneyville	Fine, mixed, mesic Typic Hapludalfs
Crider	Fine-silty, mixed, mesic Typic Paleudalfs
Dunning	Fine, mixed, mesic Fluvaquentic Haplaquolls
Elk	Fine-silty, mixed, mesic Ultic Hapludalfs
Fredonia	Fine, mixed, mesic Typic Hapludalfs
Frondorf	Fine-loamy, mixed, mesic Ultic Hapludalfs
*Grigsby	Coarse-loamy, mixed, mesic Dystric Fluventic Eutrochrepts
*Hammack	Fine-silty, mixed, mesic Glossic Paleudalfs
Lawrence	Fine-silty, mixed, mesic Aquic Fragiudalfs
Lindside	Fine-silty, mixed, mesic Fluvaquentic Eutrochrepts
Melvin	Fine-silty, mixed, nonacid, mesic Typic Fluvaquents
Newark	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Nicholson	Fine-silty, mixed, mesic Typic Fragiudalfs
Nolin	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
*Pembroke	Fine-silty, mixed, mesic Mollic Paleudalfs
Ramsey	Loamy, siliceous, mesic Lithic Dystrochrepts
Robertsville	Fine-silty, mixed, mesic Typic Fragiaqualfs
Sadler	Fine-silty, mixed, mesic Glossic Fragiudalfs
Wellston	Fine-silty, mixed, mesic Ultic Hapludalfs
Zanesville	Fine-silty, mixed, mesic Typic Fragiudalfs

*The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers, employees, and applicants for employment on the basis of race, color, national origin, age, disability, sex, gender identity, religion, reprisal, and where applicable, political beliefs, marital status, familial or parental status, sexual orientation, whether all or part of an individual's income is derived from any public assistance program, or protected genetic information. The Department prohibits discrimination in employment or in any program or activity conducted or funded by the Department. (Not all prohibited bases apply to all programs and/or employment activities.)

To File an Employment Complaint

If you wish to file an employment complaint, you must contact your agency's EEO Counselor (http://directives.sc.egov.usda.gov/33081.wba) within 45 days of the date of the alleged discriminatory act, event, or personnel action. Additional information can be found online at http://www.ascr.usda.gov/complaint_filing_file.html.

To File a Program Complaint

If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form, found online at http://www.ascr.usda.gov/complaint_filing_cust.html or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter by mail to U.S. Department of Agriculture; Director, Office of Adjudication; 1400 Independence Avenue, S.W.; Washington, D.C. 20250-9419; by fax to (202) 690-7442; or by email to program.intake@usda.gov.

Persons with Disabilities

If you are deaf, are hard of hearing, or have speech disabilities and you wish to file either an EEO or program complaint, please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

If you have other disabilities and wish to file a program complaint, please see the contact information above. If you require alternative means of communication for

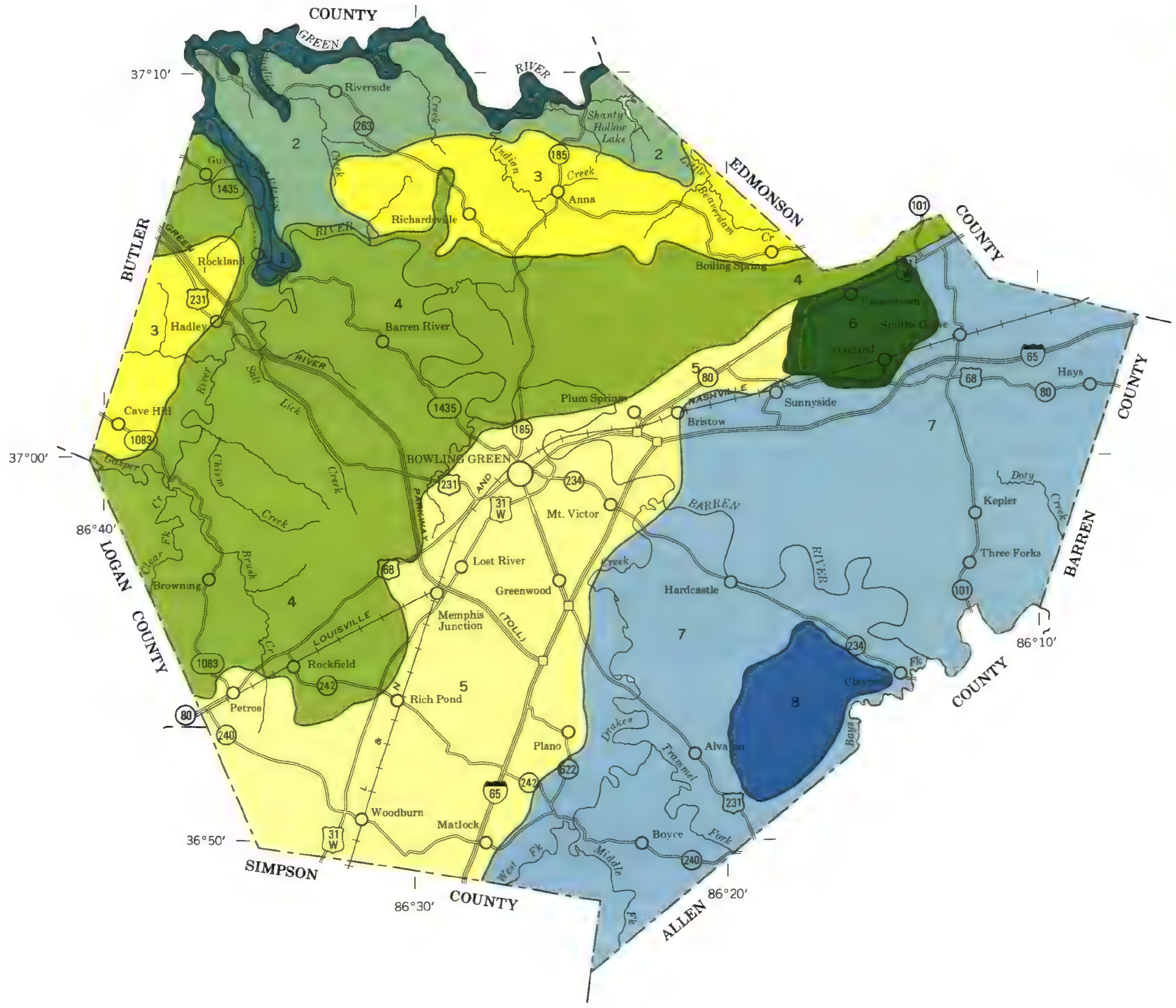
program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (http://directives.sc.egov.usda.gov/33085.wba).

All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (http://directives.sc.egov.usda.gov/33086.wba).



LEGEND

1 NEWARK-NOLIN: Deep, nearly level, somewhat poorly drained and well drained soils that have a loamy subsoil; formed in mixed alluvium on flood plains

2 FRONDORF-RAMSEY: Moderately deep and shallow, sloping to very steep, well drained and somewhat excessively drained soils that have a loamy subsoil; formed in residuum of sandstone, or in loess and the residuum of sandstone and shale on uplands

3 ZANESVILLE-SADLER: Deep, nearly level to sloping, well drained and moderately well drained soils that have a loamy subsoil that includes a fragipan; formed in loess and the residuum of sandstone, siltstone, and shale on uplands

4 FREDONIA-CANEYVILLE: Moderately deep, gently sloping to very steep, well drained soils that have a clayey subsoil; formed in residuum of limestone on uplands

5 PEMBROKE-CRIDER: Deep, nearly level to sloping, well drained soils that have a loamy and clayey subsoil; formed in loess and the residuum of limestone on uplands

6 HAMMACK-BAXTER: Deep, gently sloping to sloping, well drained soils that have a loamy and clayey subsoil; formed in loess and the residuum of cherty limestone on uplands

7 BAXTER-NICHOLSON: Deep, nearly level to steep, well drained and moderately well drained soils that have a clayey subsoil or a loamy subsoil that includes a fragipan; formed in loess and the residuum of cherty limestone on uplands

8 LAWRENCE-NICHOLSON: Deep, nearly level to gently sloping, somewhat poorly drained to moderately well drained soils that have a loamy subsoil that includes a fragipan; formed in alluvium or in loess and the residuum of limestone, on uplands

Compiled 1980

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

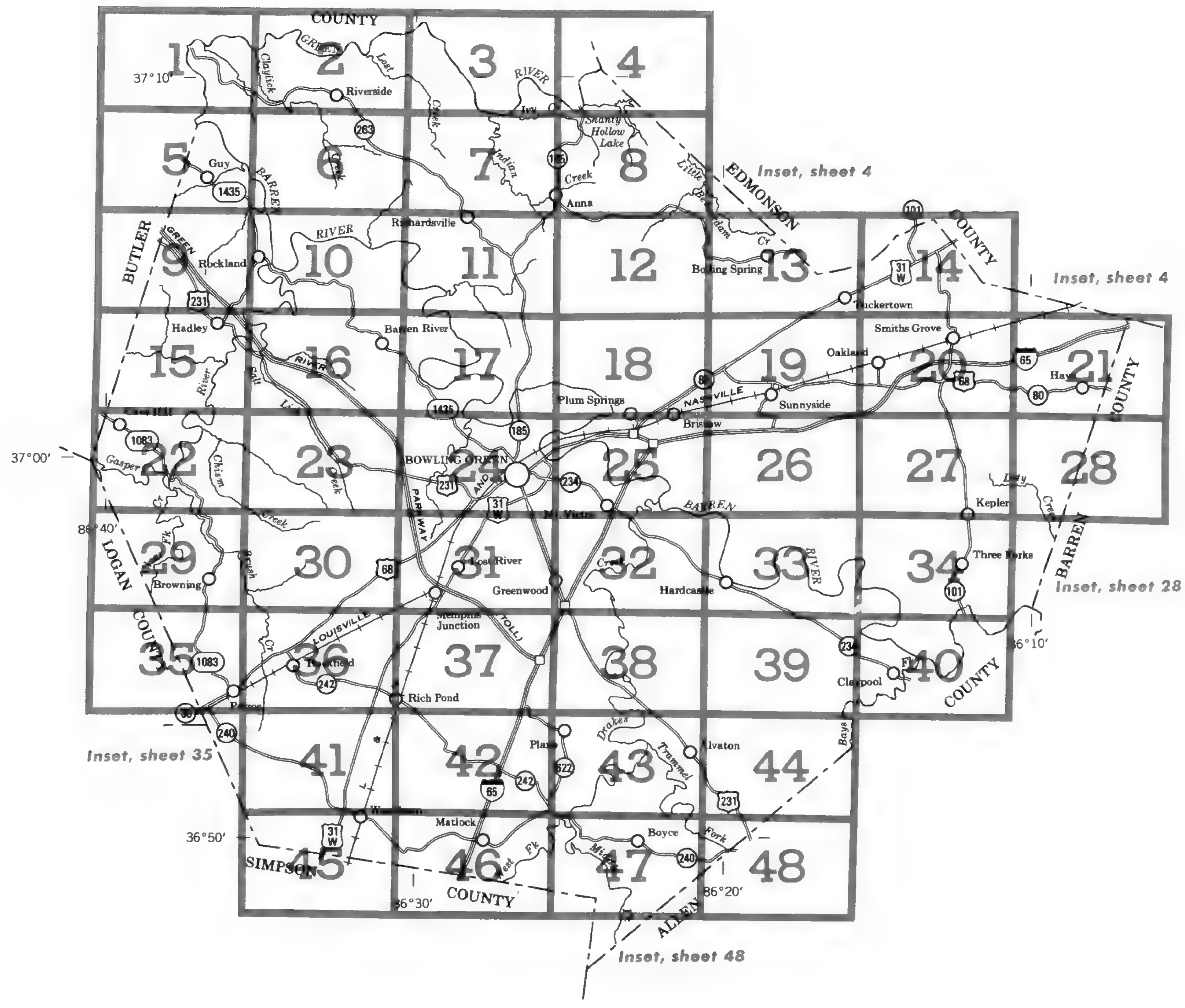
N

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KENTUCKY AGRICULTURAL EXPERIMENT STATION
AND KENTUCKY DEPARTMENT FOR NATURAL
RESOURCES AND ENVIRONMENTAL PROTECTION

GENERAL SOIL MAP

WARREN COUNTY, KENTUCKY

1 0 1 2 3 4 Miles



N

INDEX TO MAP SHEETS

WARREN COUNTY, KENTUCKY

1 0 1 2 3 4 Miles

SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The second letter is used to identify separate mapping units that begin with the same first letter. The third letter, if used, is a capital and connotes slope class. Symbols without a slope letter are for nearly level soils except for Pits which have little or no identifiable soil and variable slopes. A final number 3 in the symbol shows that the soil is severely eroded.

SYMBOL	NAME
BaB	Baxter cherty silt loam, 2 to 6 percent slopes
BaC	Baxter cherty silt loam, 6 to 12 percent slopes
BaD	Baxter cherty silt loam, 12 to 20 percent slopes
BaE	Baxter cherty silt loam, 20 to 30 percent slopes
BbC3	Baxter cherty silty clay loam, 6 to 12 percent slopes, severely eroded
BbD3	Baxter cherty silty clay loam, 12 to 20 percent slopes, severely eroded
CaB	Caneyville silt loam, 2 to 6 percent slopes
CaC	Caneyville silt loam, 6 to 12 percent slopes
CnC3	Caneyville silty clay, 6 to 12 percent slopes, severely eroded
CoD	Caneyville-Rock outcrop complex, 6 to 20 percent slopes
CoE	Caneyville-Rock outcrop complex, 20 to 35 percent slopes
CrB	Crider silt loam, 2 to 6 percent slopes
CrC	Crider silt loam, 6 to 12 percent slopes
Du	Dunning silty clay loam
ElB	Elk silt loam, 2 to 6 percent slopes
FeC	Fredonia silt loam, very rocky, 2 to 12 percent slopes
FnC	Fredonia-Urban land complex, 2 to 12 percent slopes
FrC	Frondorf silt loam, 6 to 12 percent slopes
FrD	Frondorf silt loam, 12 to 20 percent slopes
Gr	Grigsby sandy loam
HaB	Hammack silt loam, 2 to 6 percent slopes
La	Lawrence silt loam
Ld	Lindside silt loam
Me	Melvin silt loam
Ne	Newark silt loam
NhA	Nicholson silt loam, 0 to 2 percent slopes
NhB	Nicholson silt loam, 2 to 6 percent slopes
No	Nolin silt loam
PeA	Pembroke silt loam, 0 to 2 percent slopes
PeB	Pembroke silt loam, 2 to 6 percent slopes
PeC	Pembroke silt loam, 6 to 12 percent slopes
PfC3	Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded
PrB	Pembroke-Urban land complex, 2 to 6 percent slopes
PrC	Pembroke-Urban land complex, 6 to 12 percent slopes
Pt	Pits
RfE	Ramsey-Frondorf complex, 20 to 40 percent slopes
Ro	Robertsville silt loam
RxE	Rock outcrop-Caneyville complex, 20 to 40 percent slopes
SaA	Sadler silt loam, 0 to 2 percent slopes
SaB	Sadler silt loam, 2 to 6 percent slopes
WeB	Wellston silt loam, 2 to 6 percent slopes
WeC	Wellston silt loam, 6 to 12 percent slopes
ZaB	Zanesville silt loam, 2 to 6 percent slopes
ZaC	Zanesville silt loam, 6 to 12 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Hedley Airstrip

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CnB; WaC2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

1

WARREN COUNTY, KENTUCKY NO. 1

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

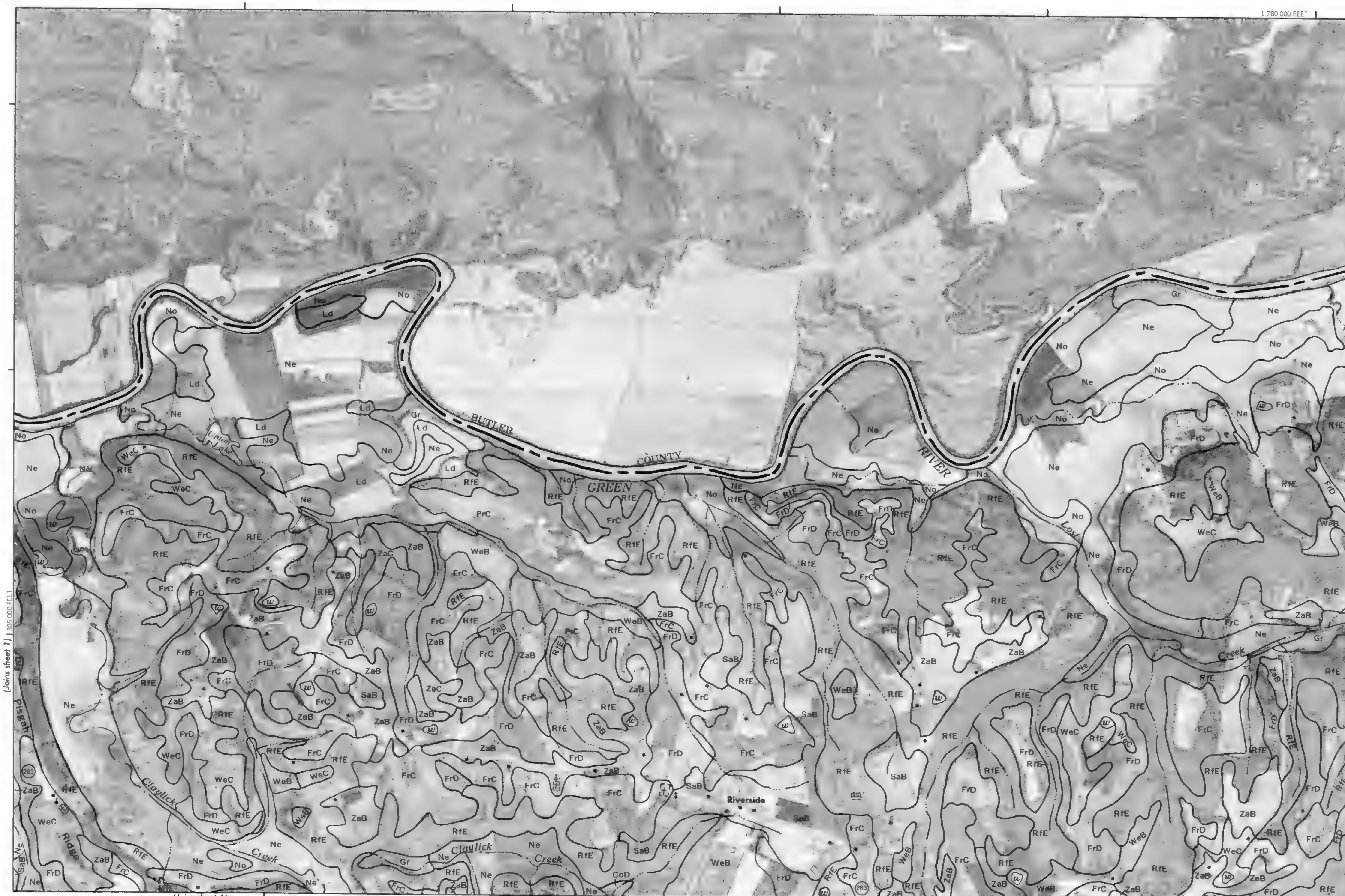
2

N

Scale 1:20000

1 Mile · ¾ · ½ · ¼ · 0

5000 Feet · 4000 · 3000 · 2000 · 1000 · 0



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3

WARREN COUNTY, KENTUCKY NO. 3

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
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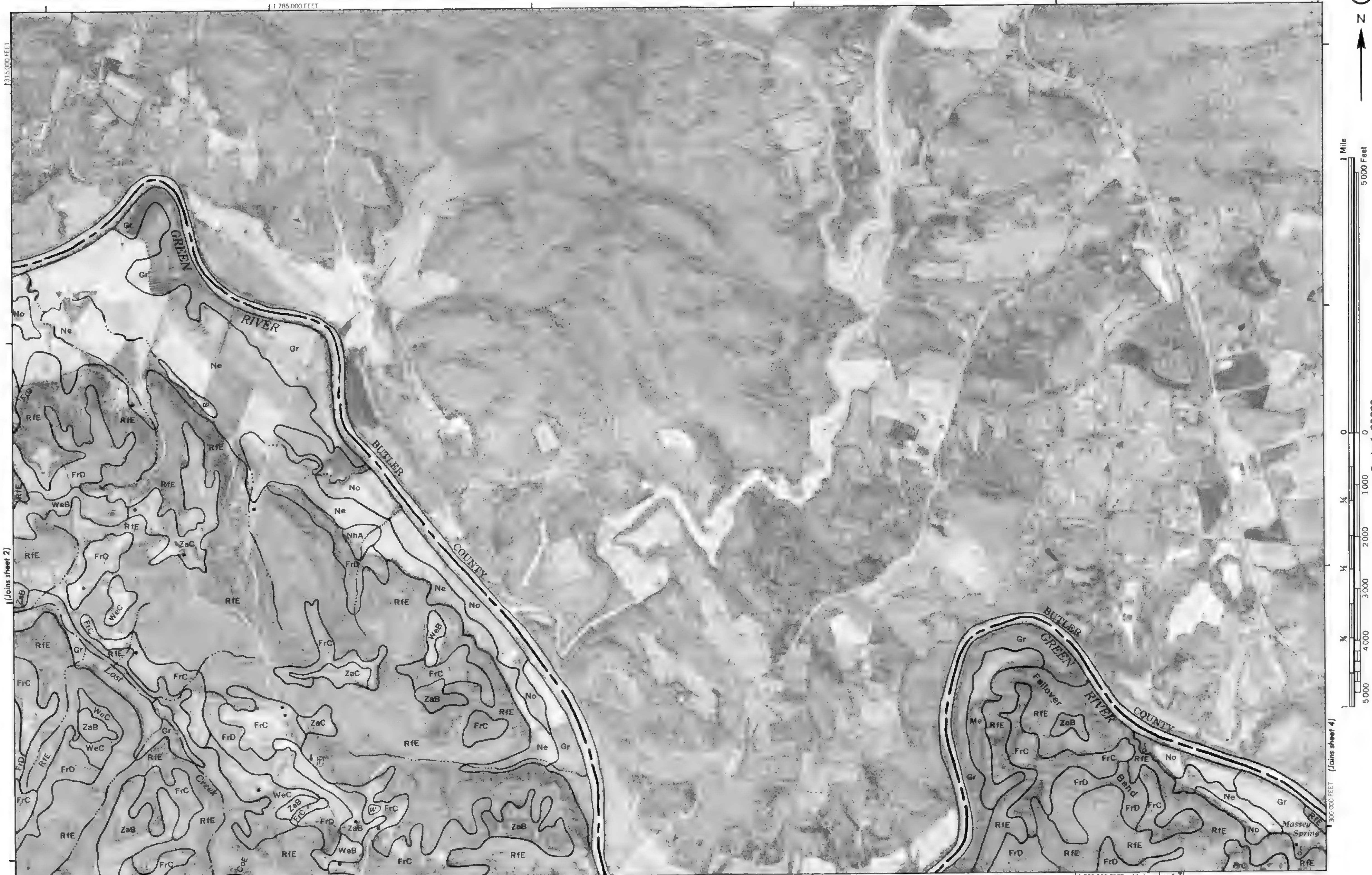

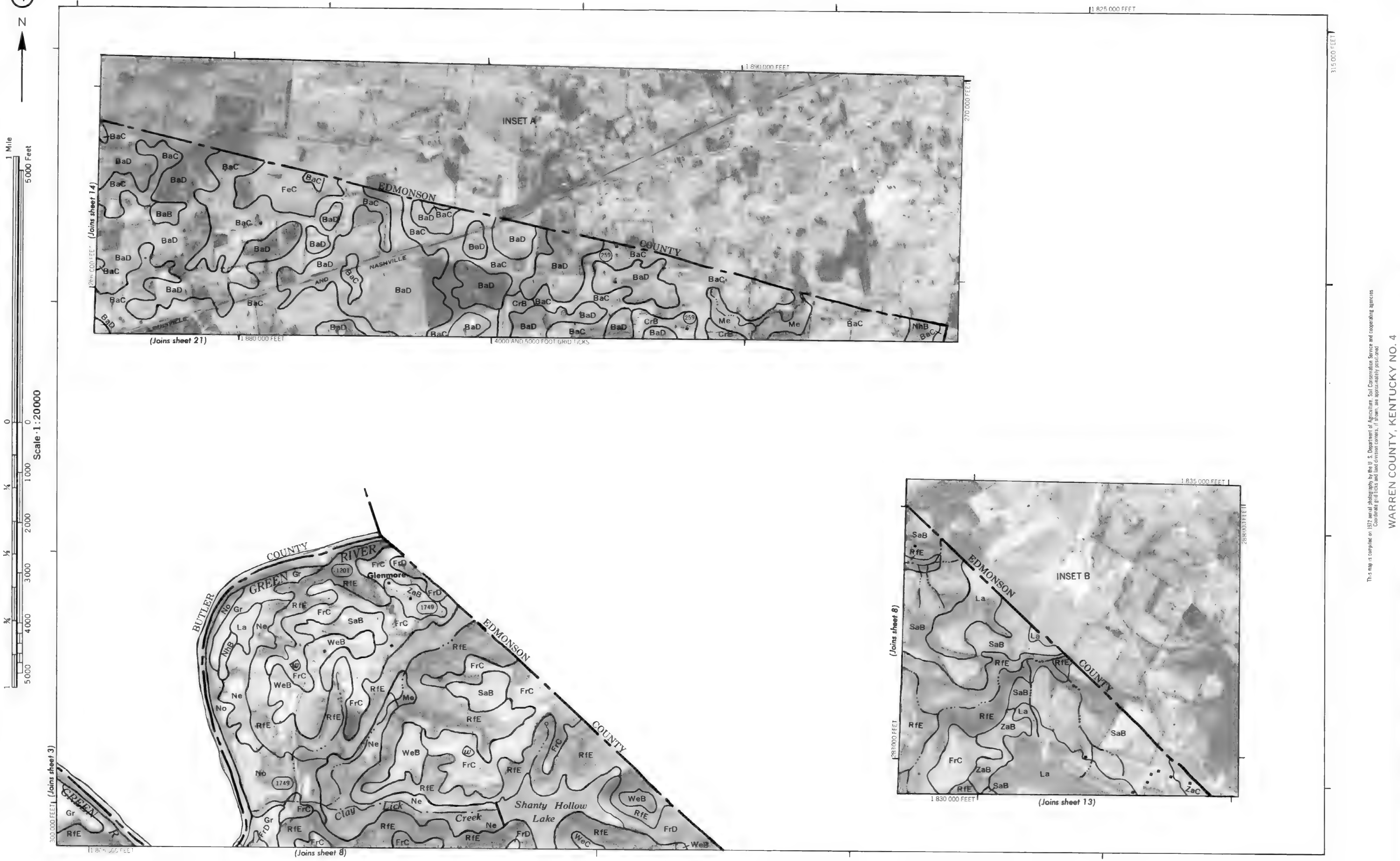
4
N
1 Mile
5000 Feet
Scale 1:20000
INSET A
EDMONSON COUNTY
NASHVILLE
(Joins sheet 14)
(Joins sheet 21)
1 890 000 FEET
1 880 000 FEET
270 000 FEET
4000 AND 5000 FOOT GRID TICKS
1 825 000 FEET
315 000 FEET
BUTLER COUNTY
GREEN RIVER
Glenmore
EDMONSON COUNTY
Clay Lick Creek
Shanty Hollow Lake
(Joins sheet 3)
(Joins sheet 8)
300 000 FEET
INSET B
EDMONSON COUNTY
(Joins sheet 8)
(Joins sheet 13)
1 835 000 FEET
1 830 000 FEET
WARREN COUNTY, KENTUCKY NO. 4
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WARREN COUNTY, KENTUCKY NO. 5

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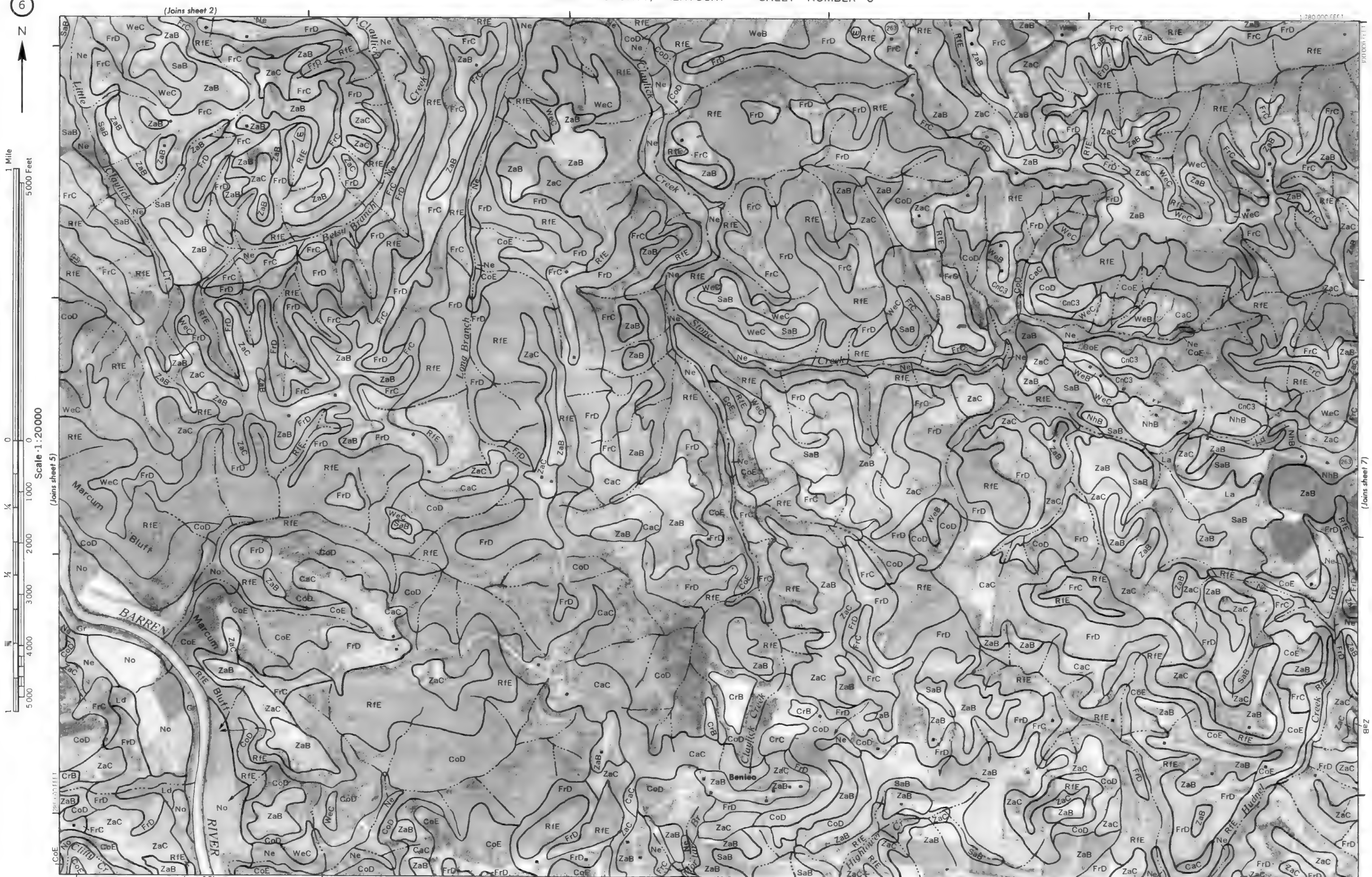
WARREN COUNTY, KENTUCKY — SHEET NUMBER 6



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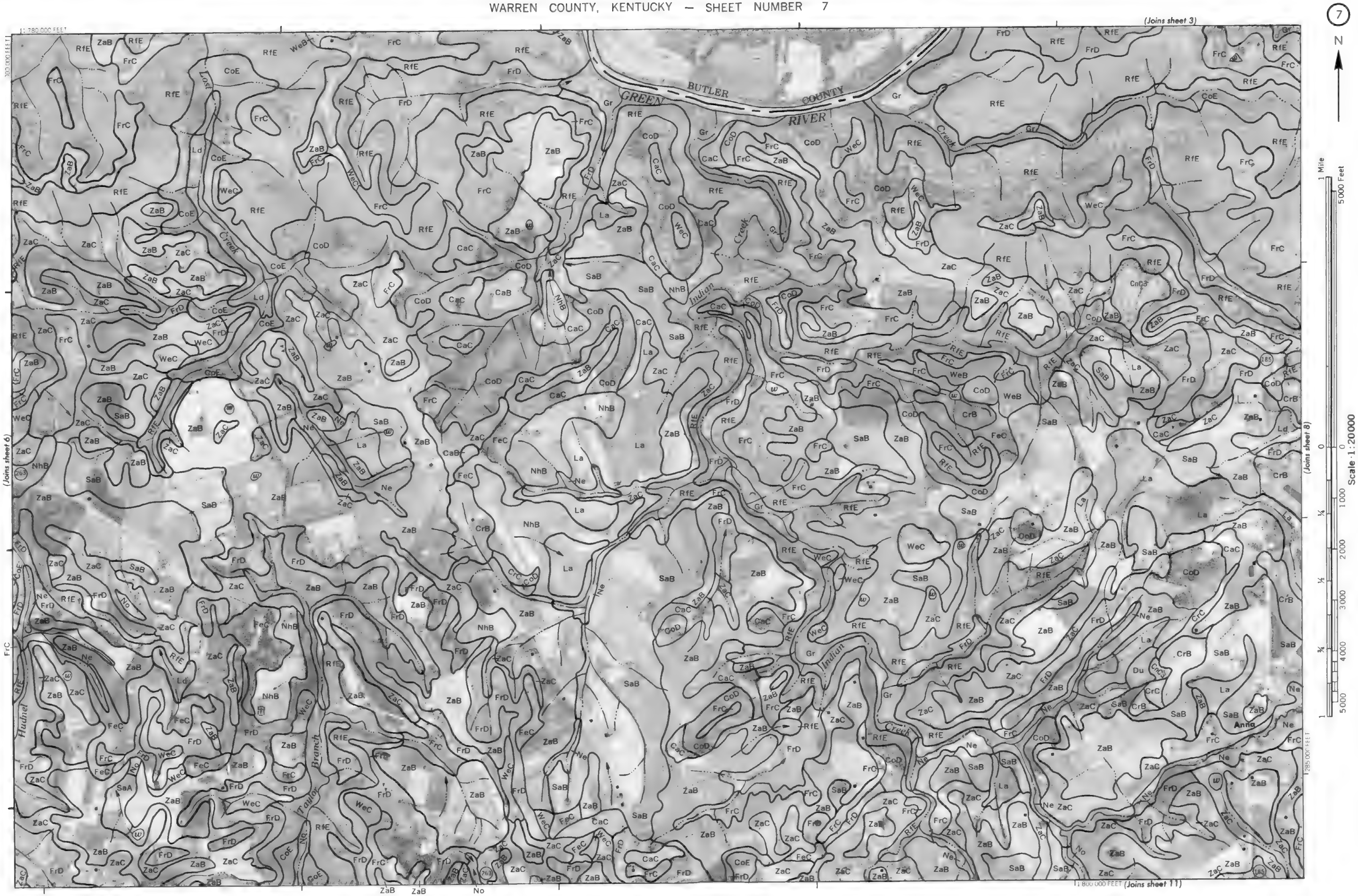
WARREN COUNTY, KENTUCKY NO. 6



WARREN COUNTY, KENTUCKY NO. 7

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

1 Mile

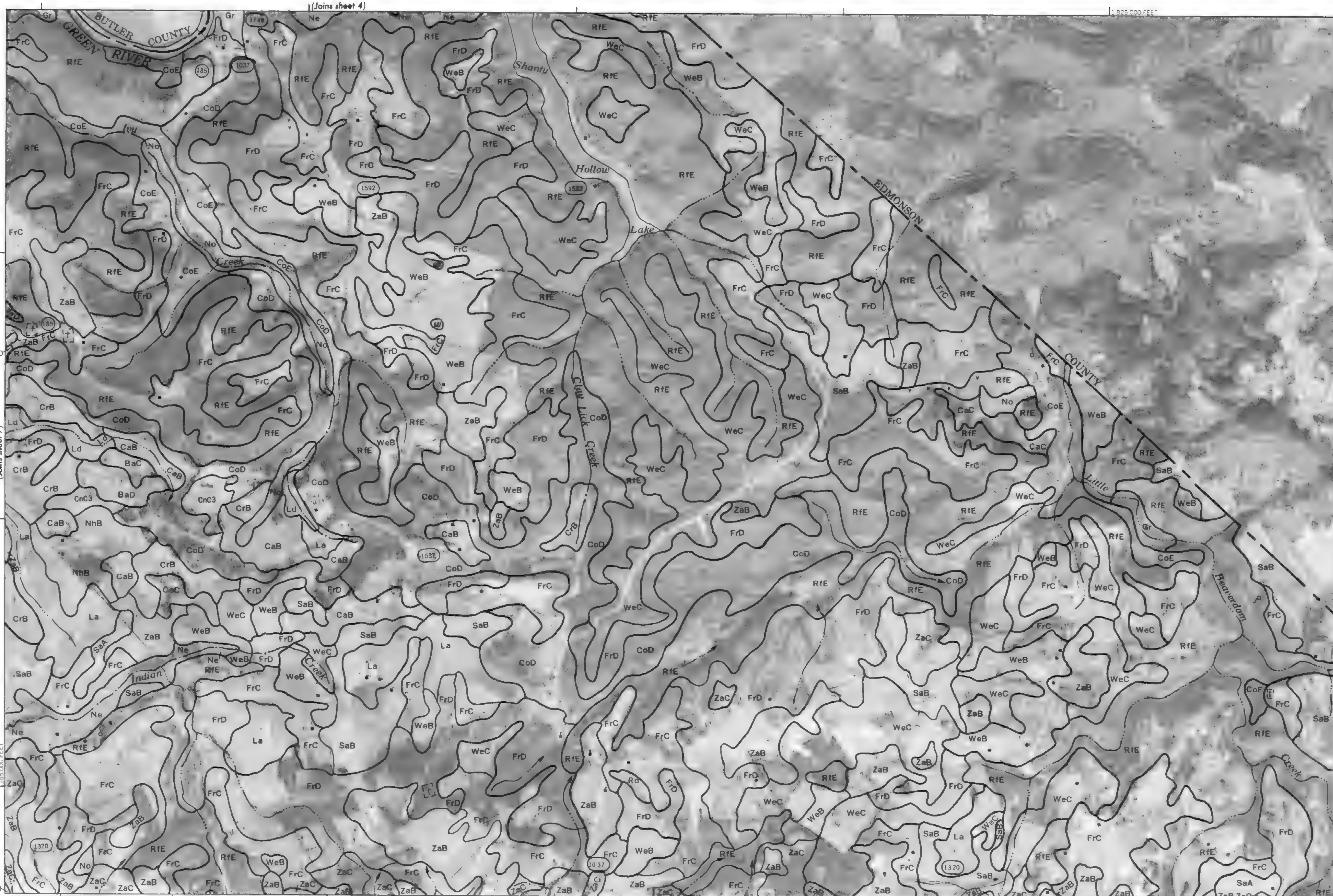
5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

(Joins sheet 4)



(Joins sheet 7)

(Joins sheet 12)

(Joins inset A, sheet 4)

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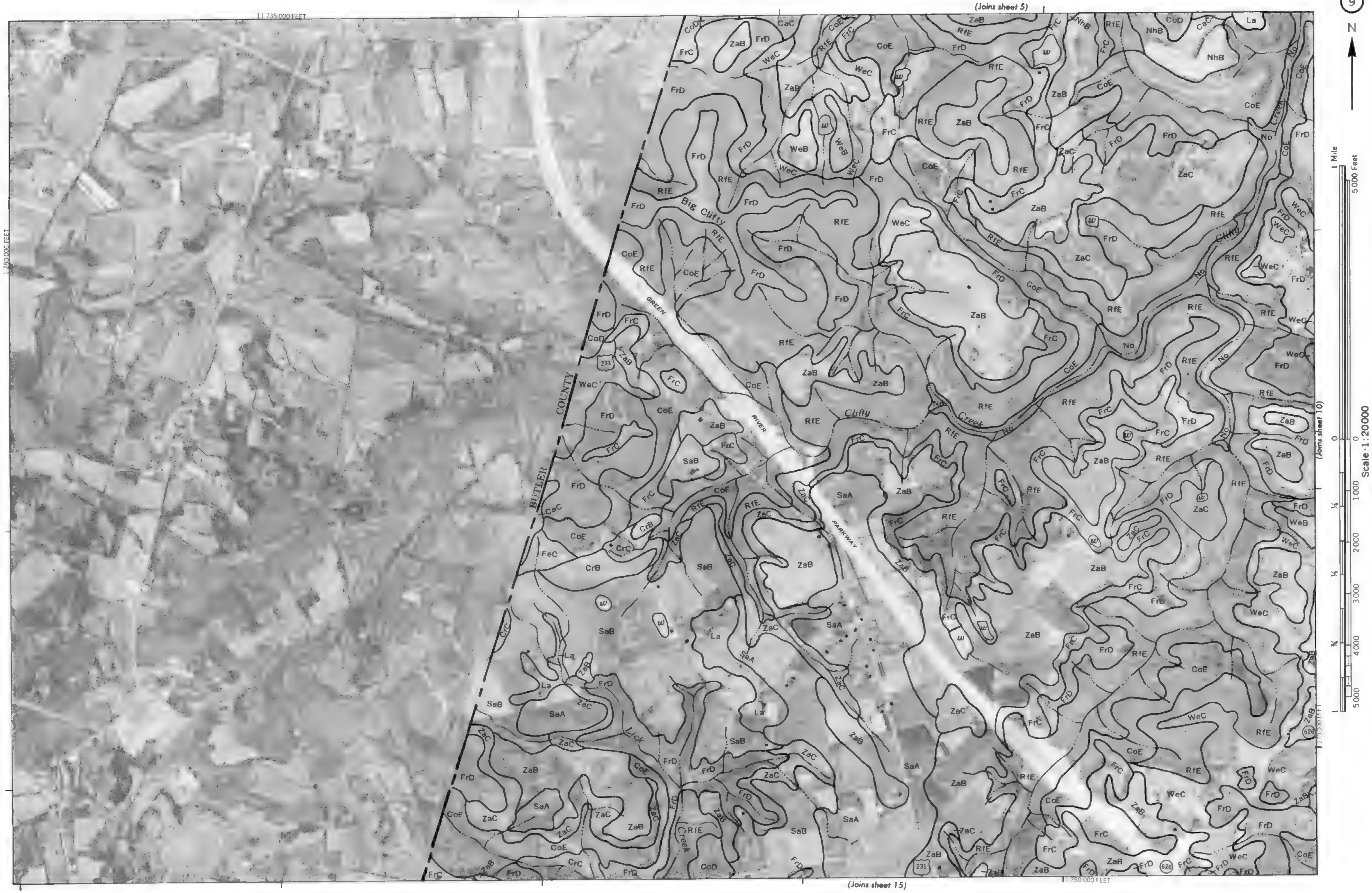

WARREN COUNTY, KENTUCKY NO. 9

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WARREN COUNTY, KENTUCKY NO. 11

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WARREN COUNTY, KENTUCKY — SHEET NUMBER 12

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WARREN COUNTY, KENTUCKY NO. 12

WARREN COUNTY, KENTUCKY NO. 13

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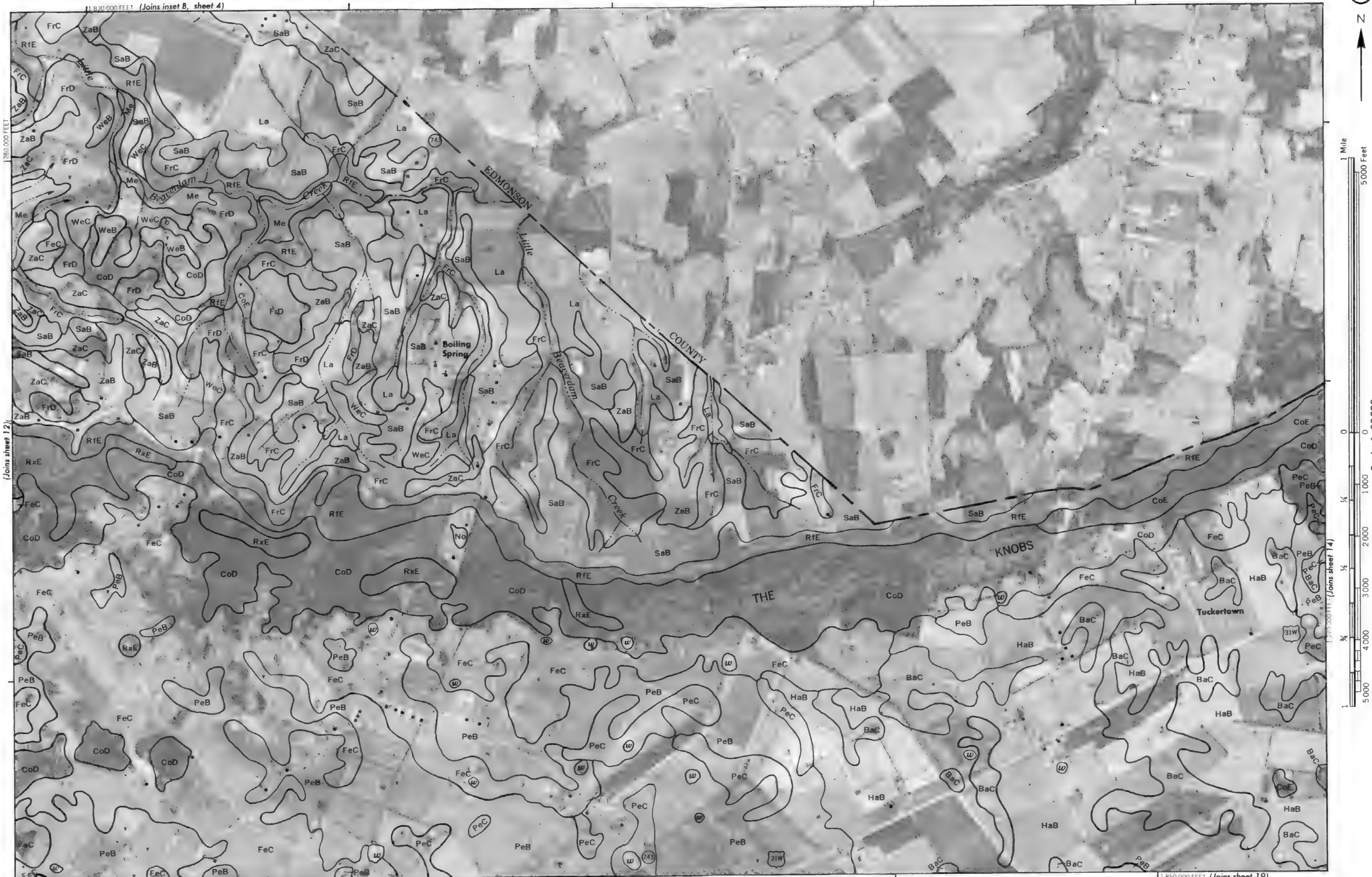

WARREN COUNTY, KENTUCKY — SHEET NUMBER 14

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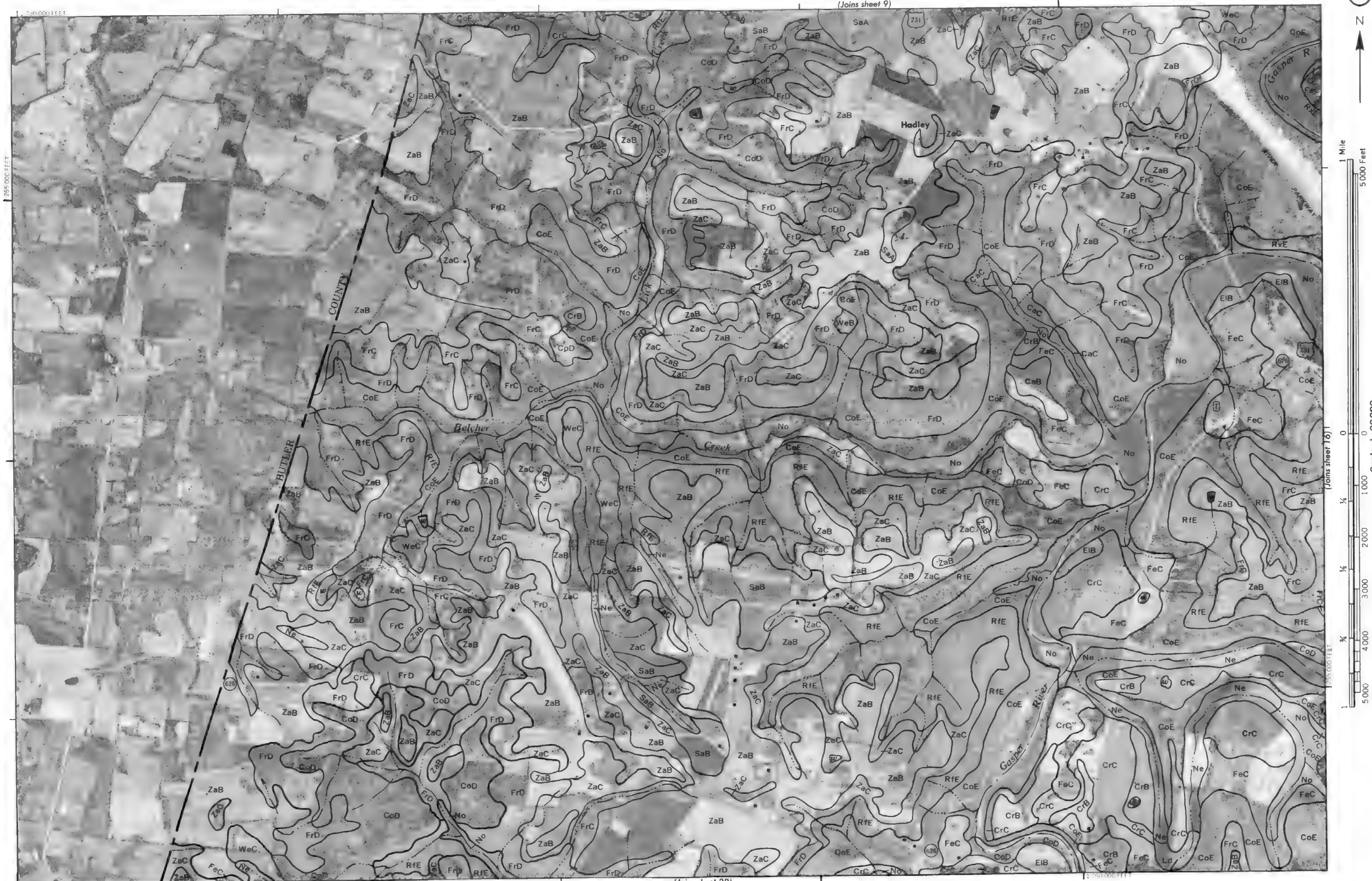
WARREN COUNTY, KENTUCKY NO. 14



WARREN COUNTY, KENTUCKY NO. 15

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WARREN COUNTY, KENTUCKY — SHEET NUMBER 16

WARREN COUNTY, KENTUCKY NO. 17

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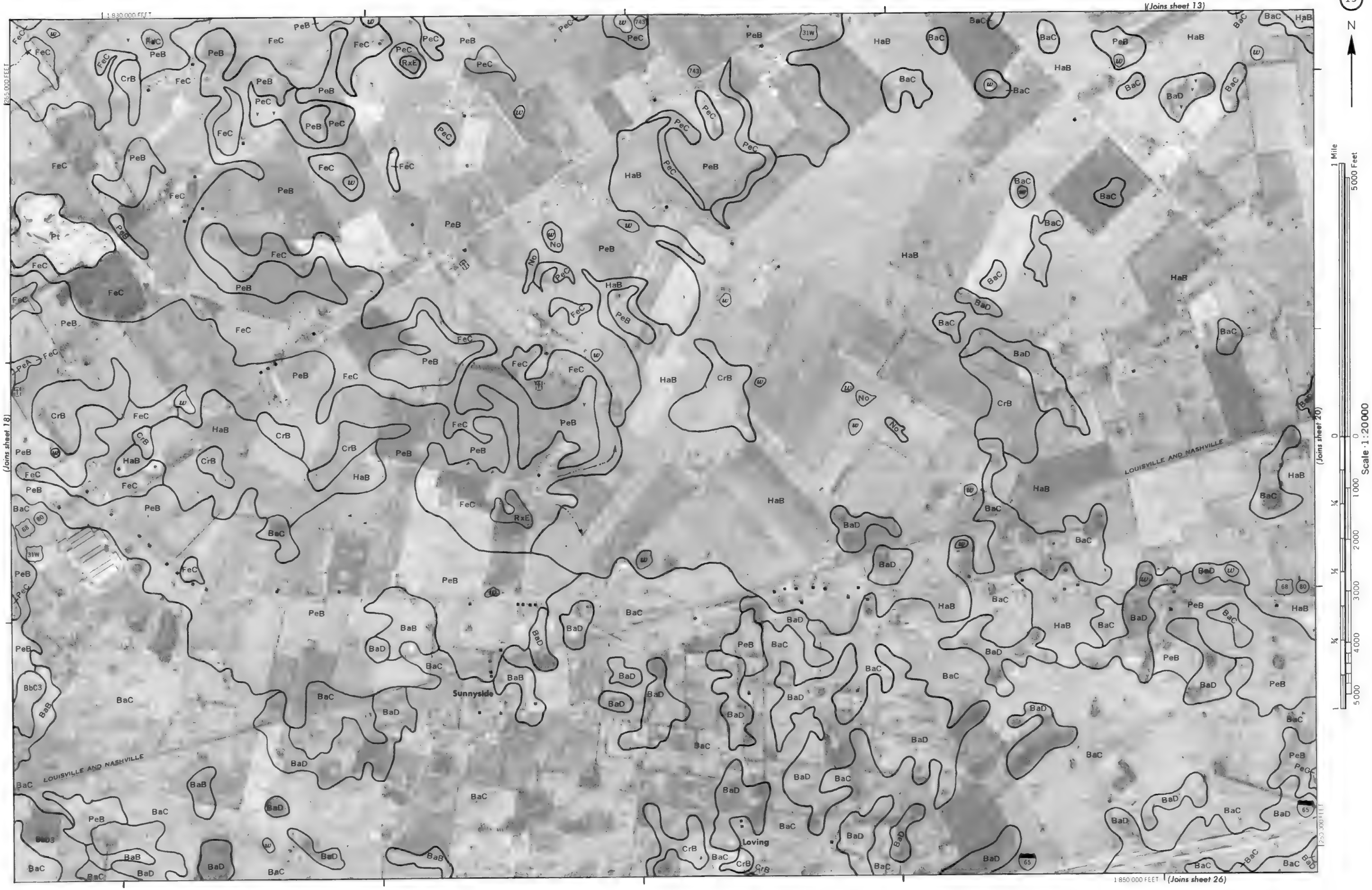
WARREN COUNTY, KENTUCKY NO. 18



WARREN COUNTY, KENTUCKY NO. 19

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WARREN COUNTY, KENTUCKY NO. 21

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WARREN COUNTY, KENTUCKY — SHEET NUMBER 22

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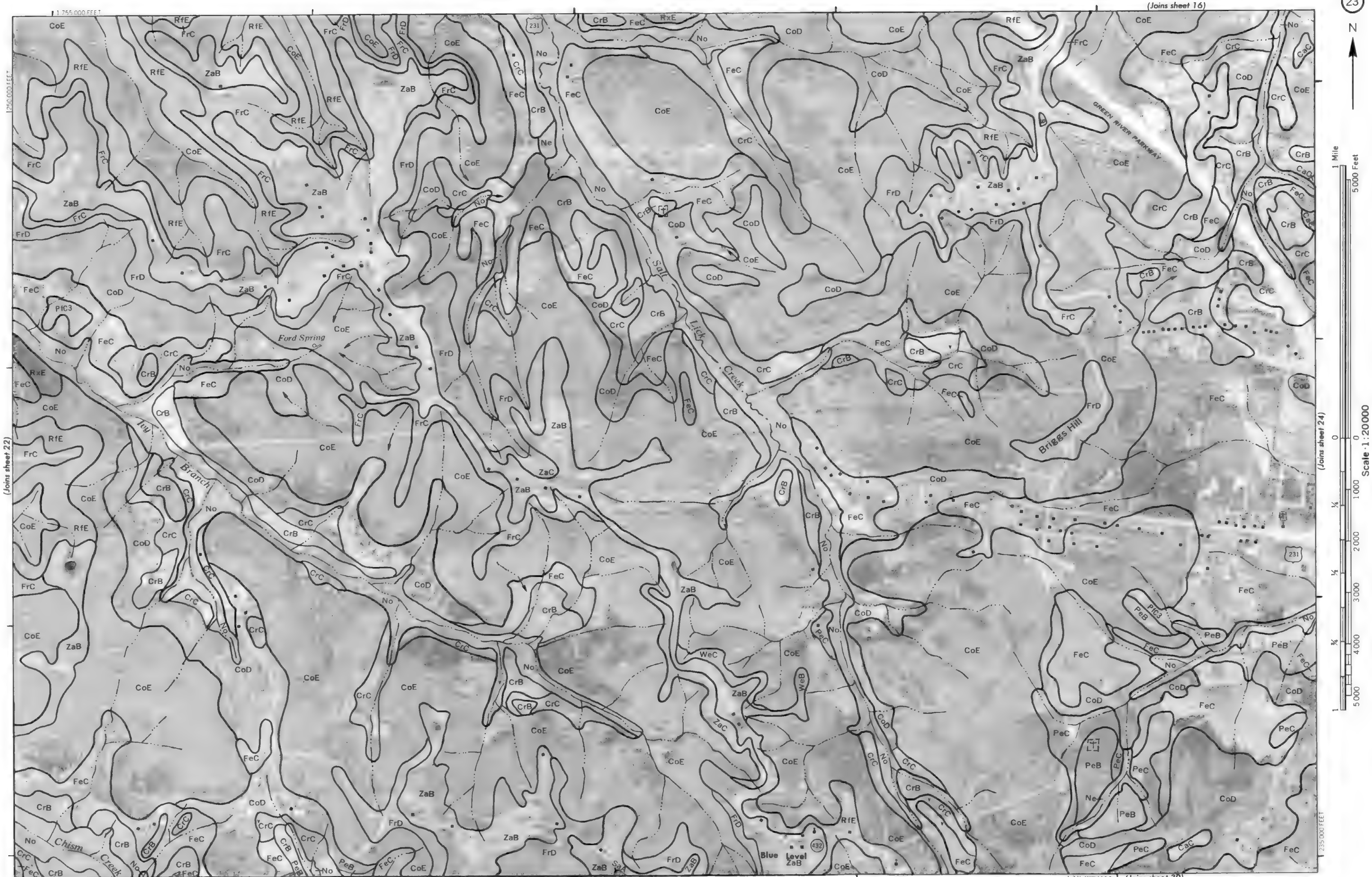
23



WARREN COUNTY, KENTUCKY, NO. 23

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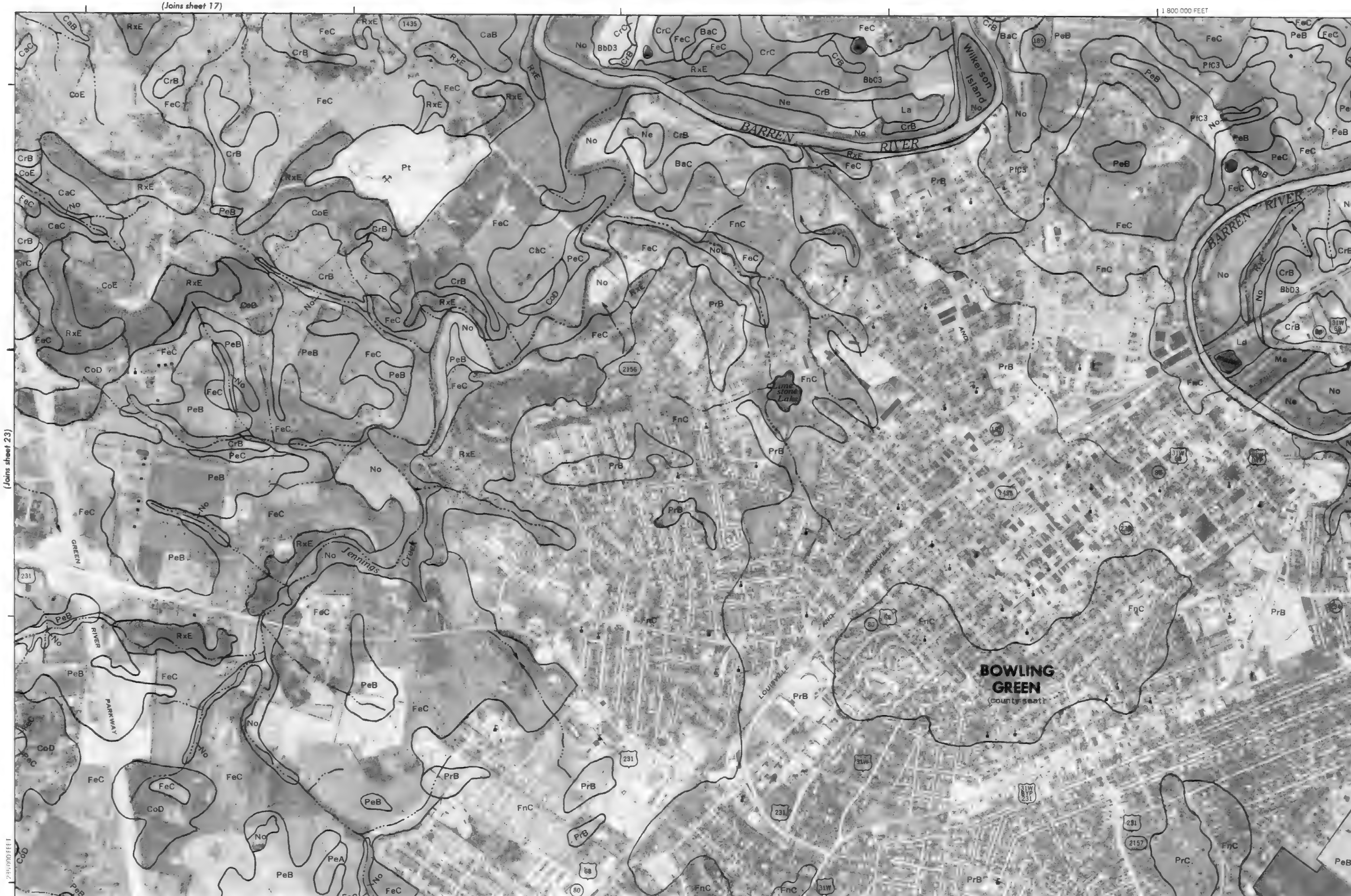
(Joins sheet 17)



N

Scale 1:20000

1 Mile, 0, ¼, ½, ¾, 1

5 000 Feet, 0, 1000, 2000, 3000, 4000, 5000

(Joins sheet 23)

(Joins sheet 25)

(Joins sheet 31)

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WARREN COUNTY, KENTUCKY NO. 25

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WARREN COUNTY, KENTUCKY NO. 26

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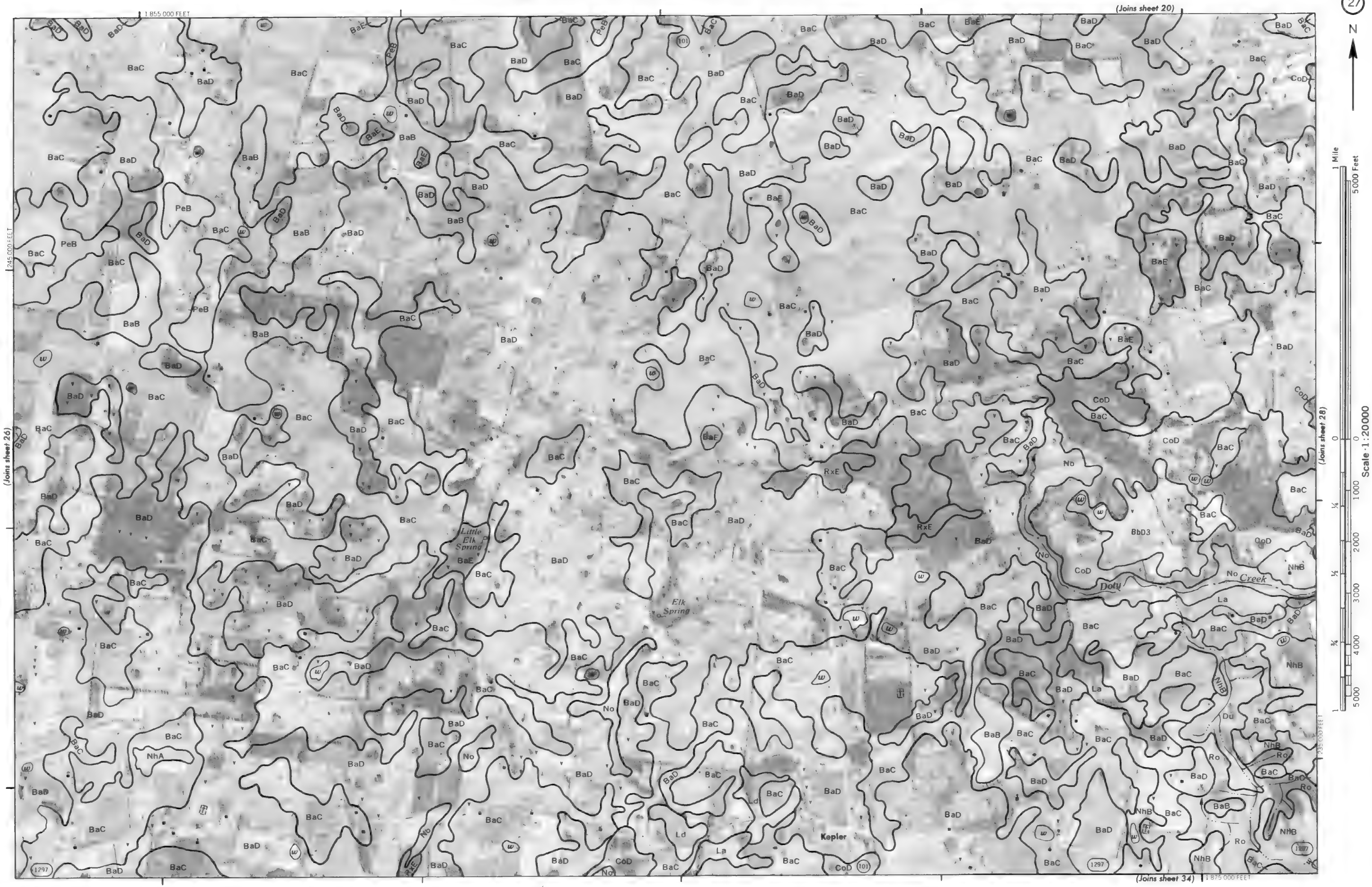

WARREN COUNTY, KENTUCKY NO. 27

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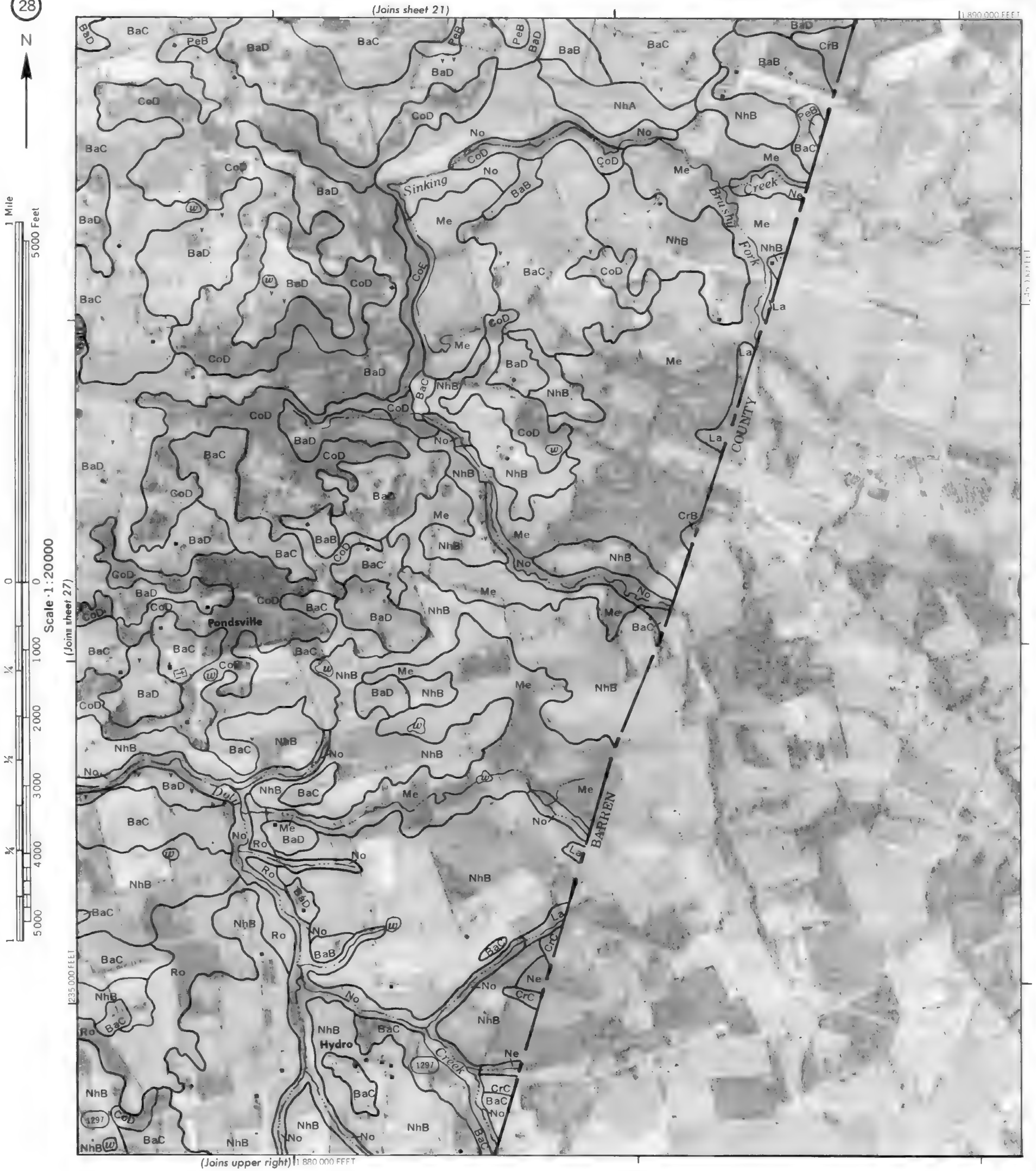

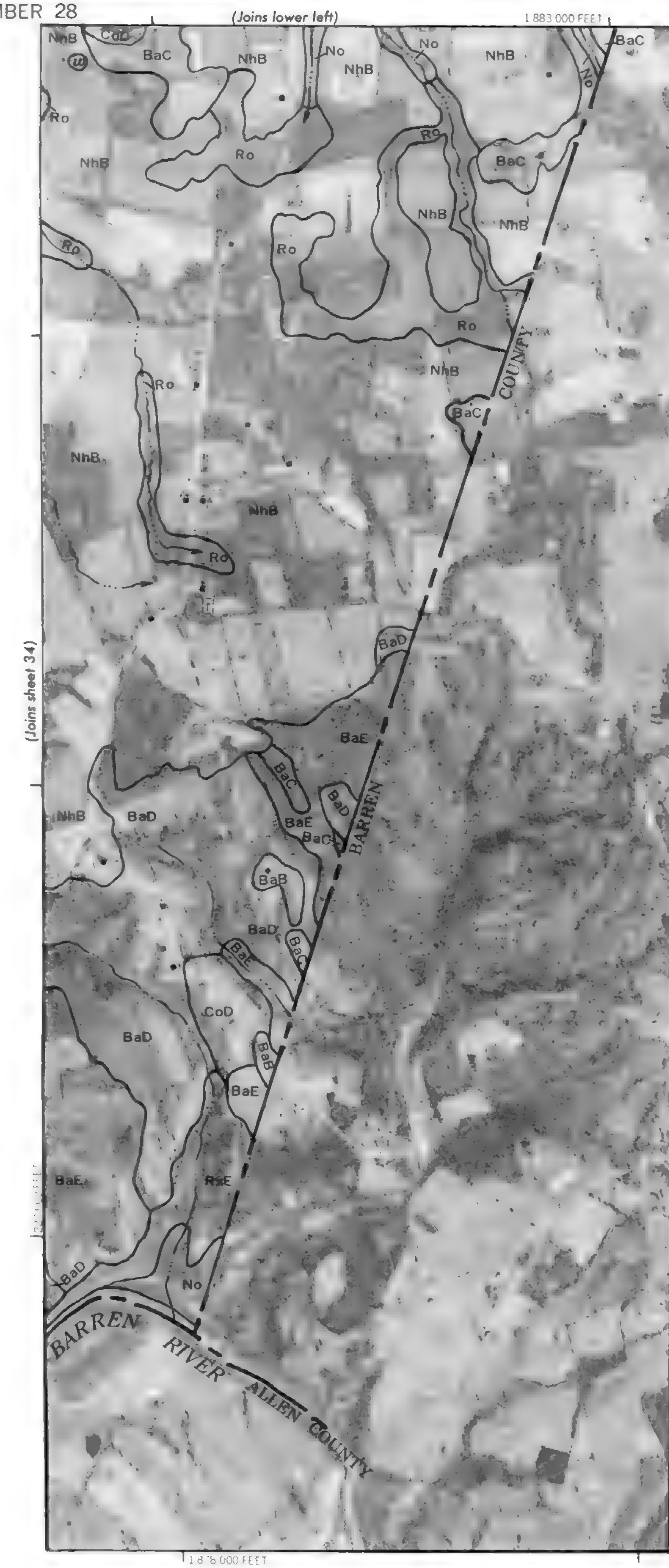

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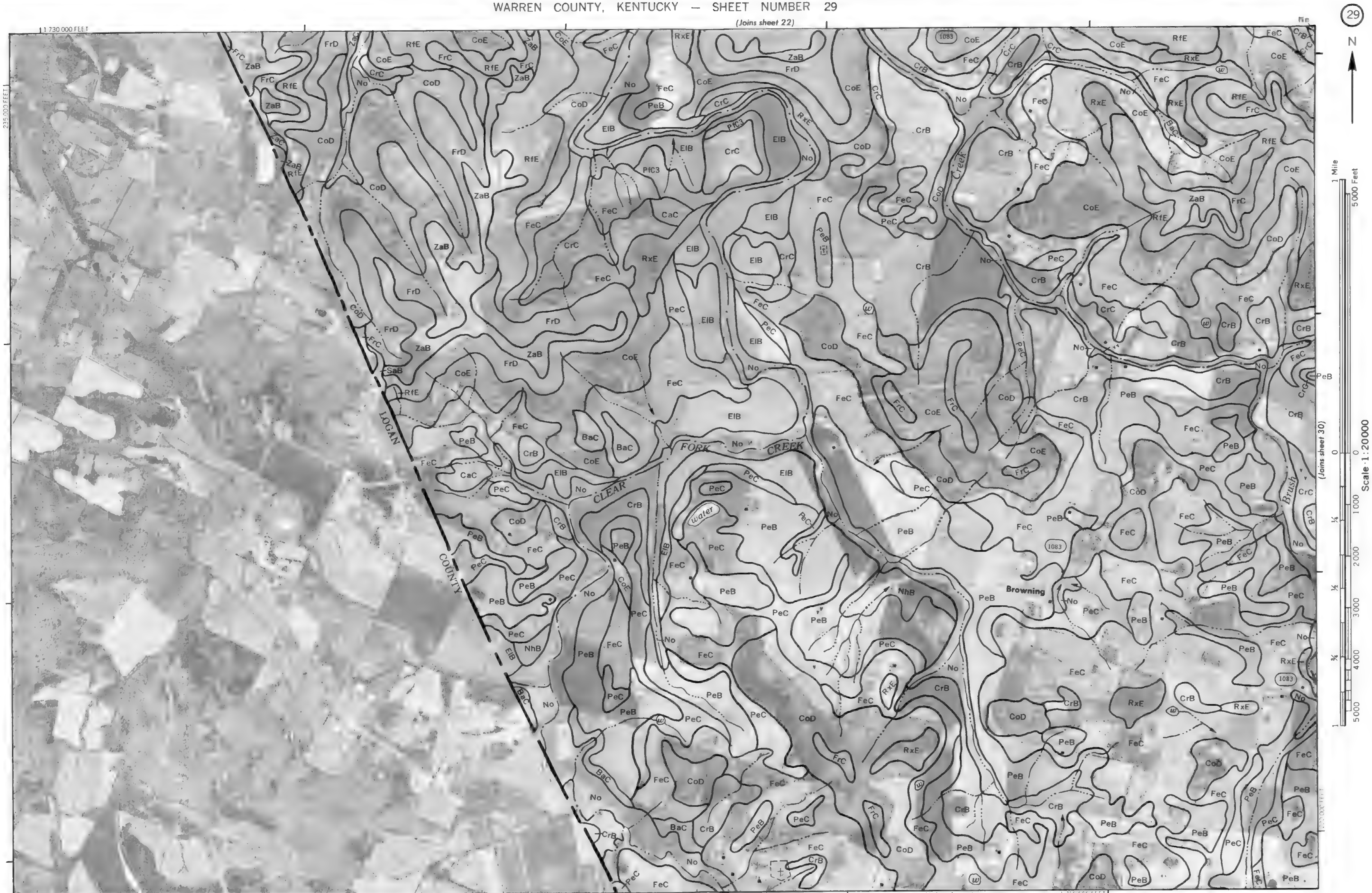

WARREN COUNTY, KENTUCKY NO. 29

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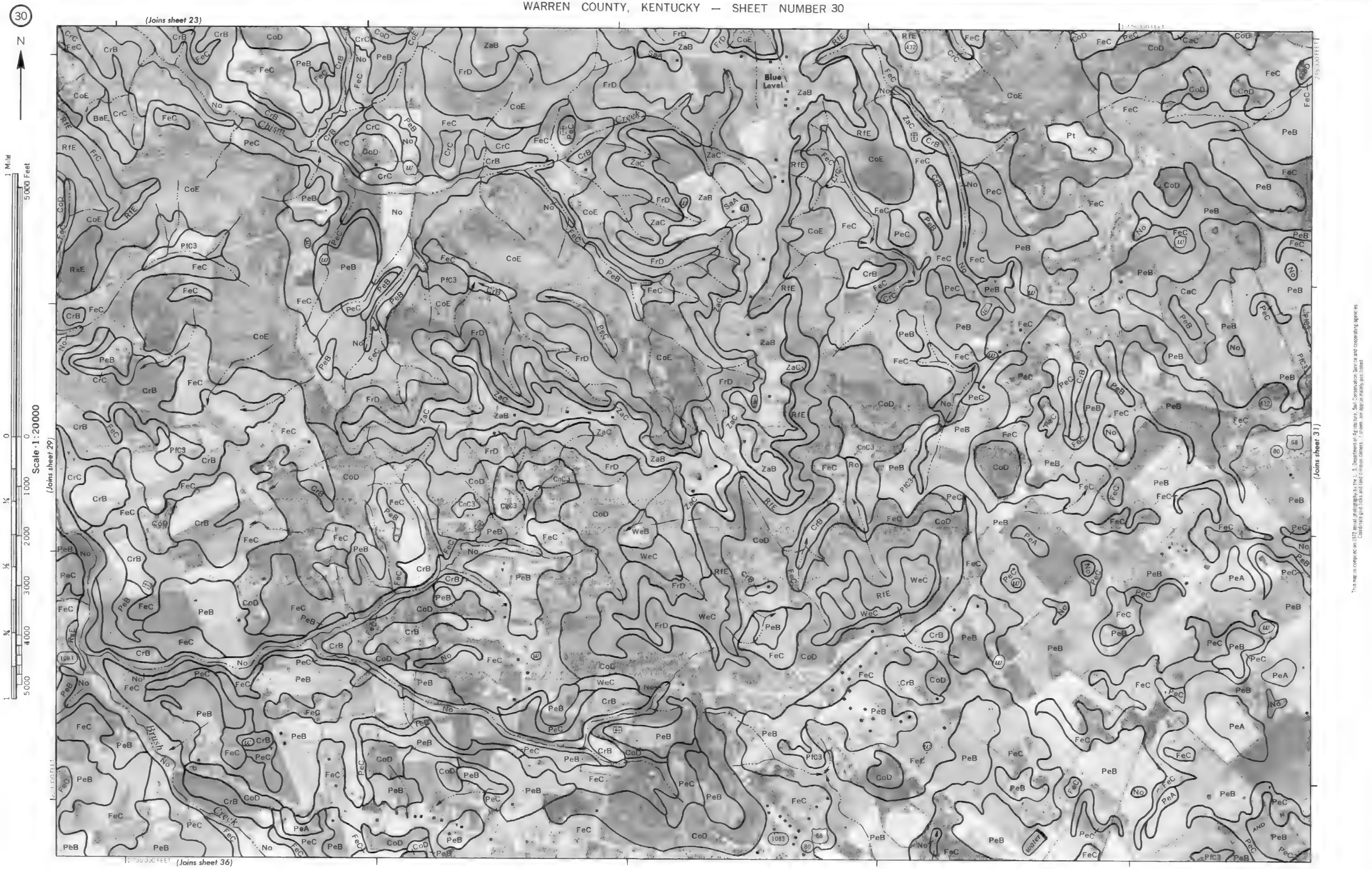
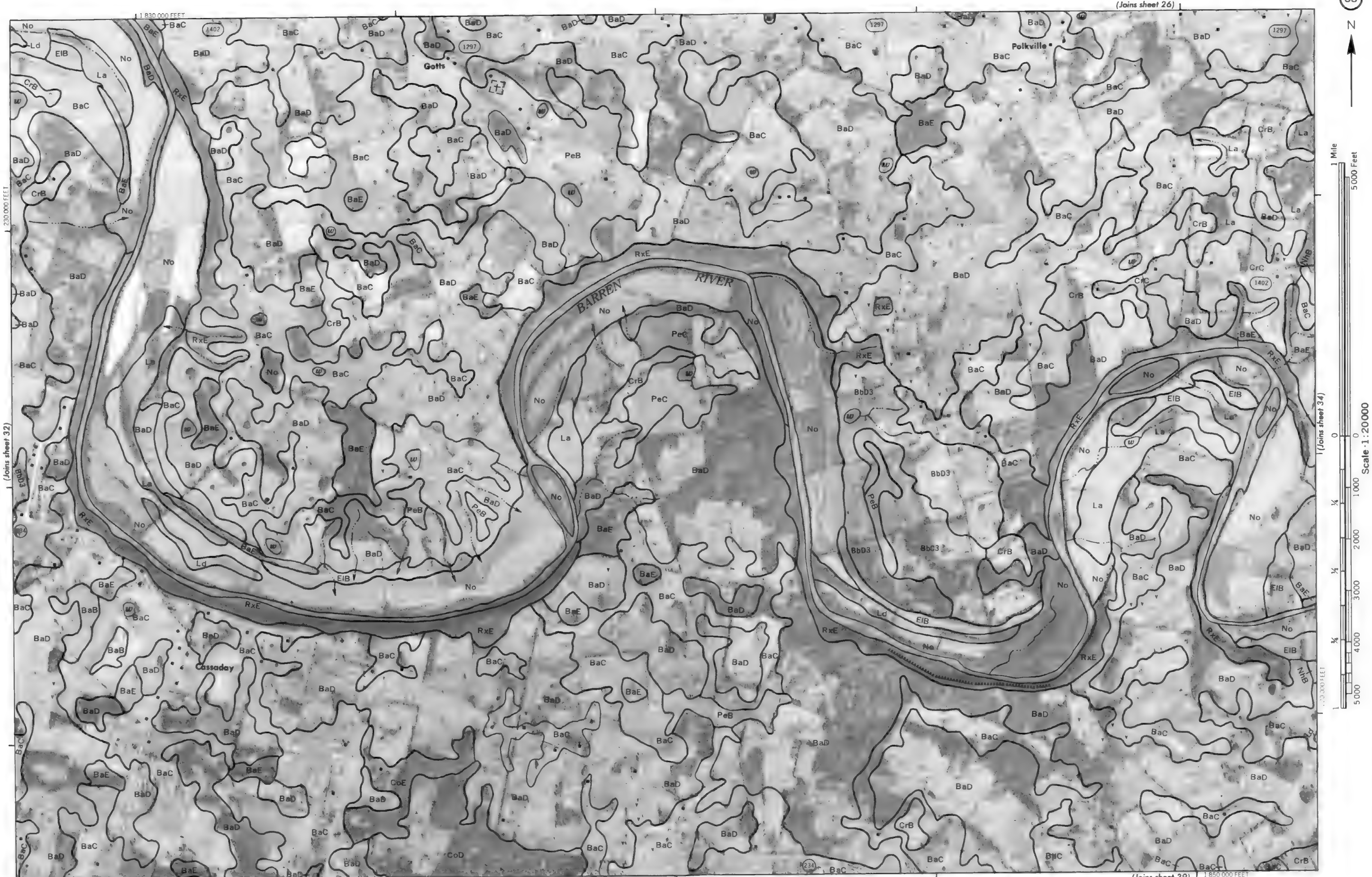

30
N
(Joins sheet 23)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 36)
Blue Level
Chism Creek
Brush Creek
Scale 1:20000
1 Mile
5000 Feet
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.
WARREN COUNTY, KENTUCKY NO. 30

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WARREN COUNTY, KENTUCKY — SHEET NUMBER 32

N

1 Mile
5000 Feet
Scale 1:20000
0 1000 2000 3000 4000 5000



WARREN COUNTY, KENTUCKY NO. 33

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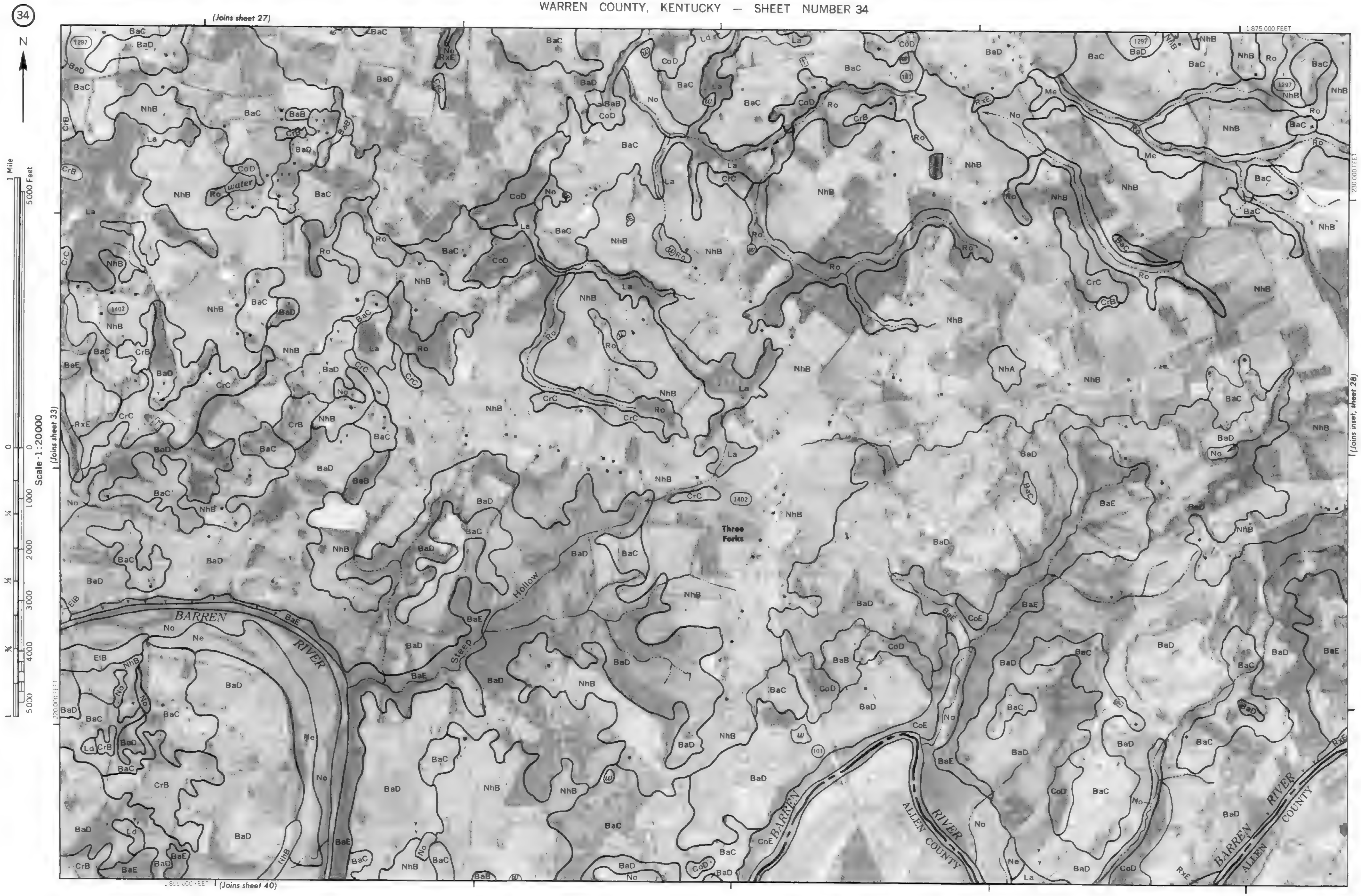
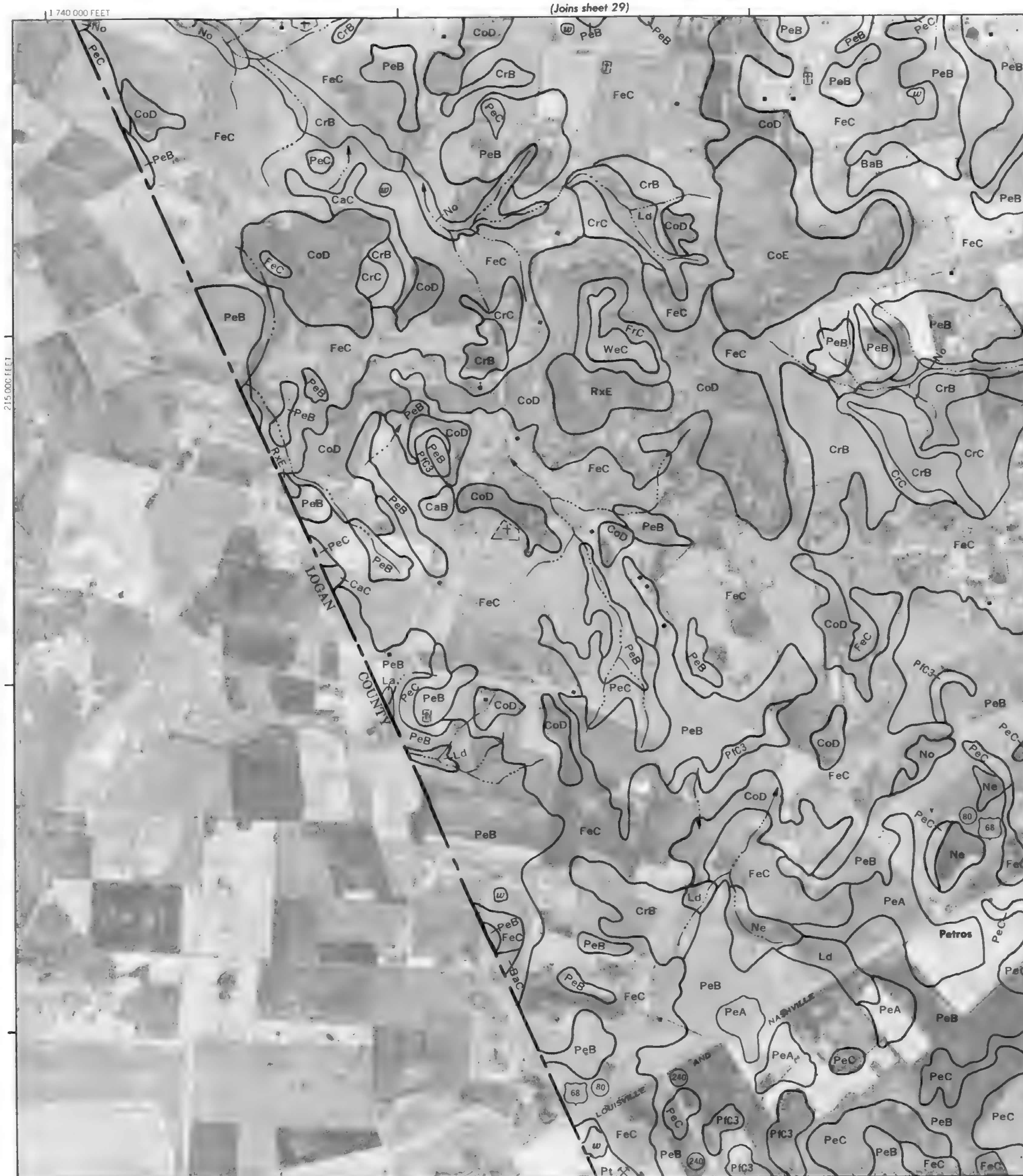
WARREN COUNTY, KENTUCKY — SHEET NUMBER 34



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

35



N

Scale 1:20000

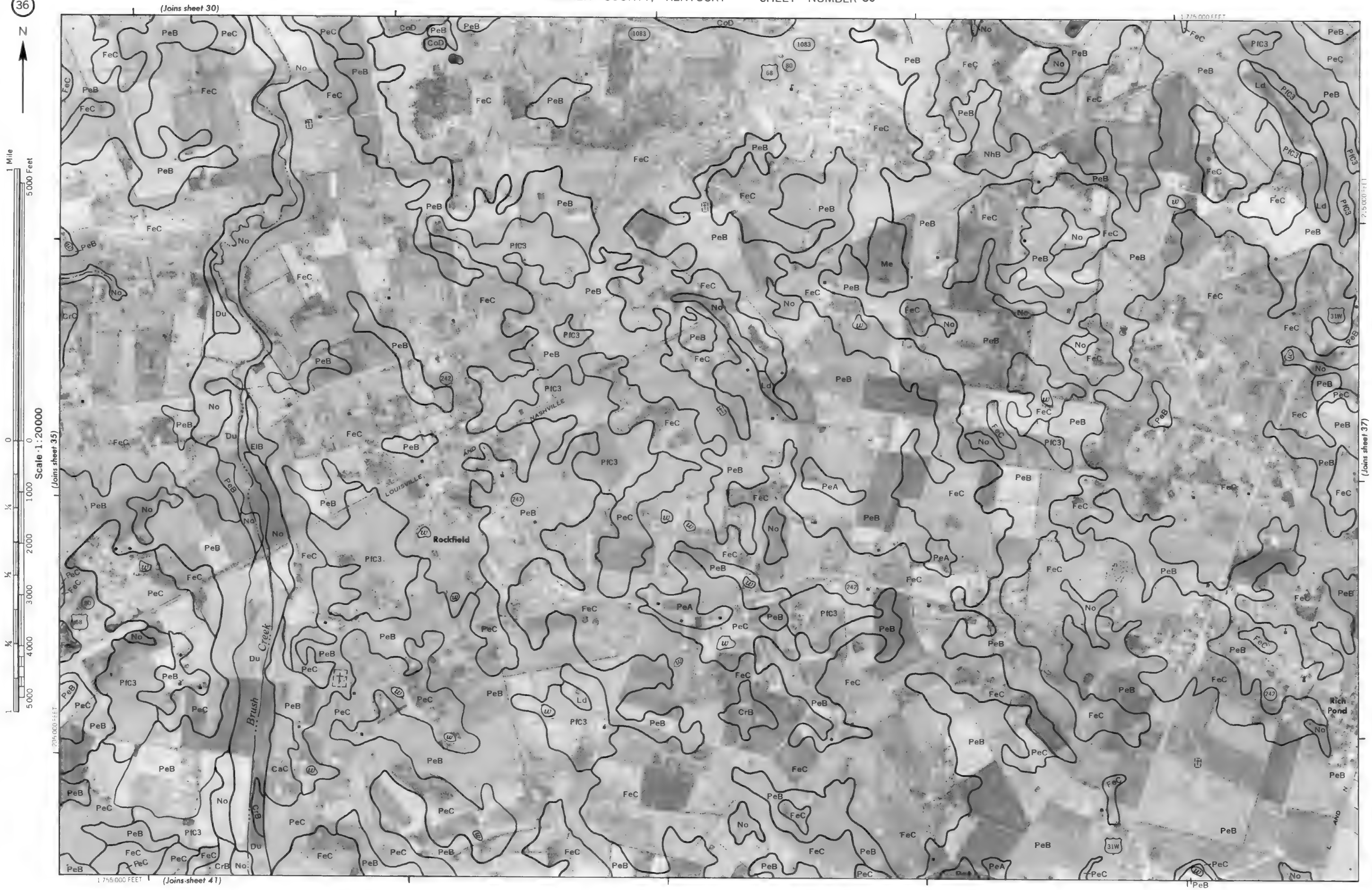
1 Mile ½ ¼ 0

5000 Feet 4000 3000 2000 1000 0

WARREN COUNTY, KENTUCKY NO. 35

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WARREN COUNTY, KENTUCKY — SHEET NUMBER 36



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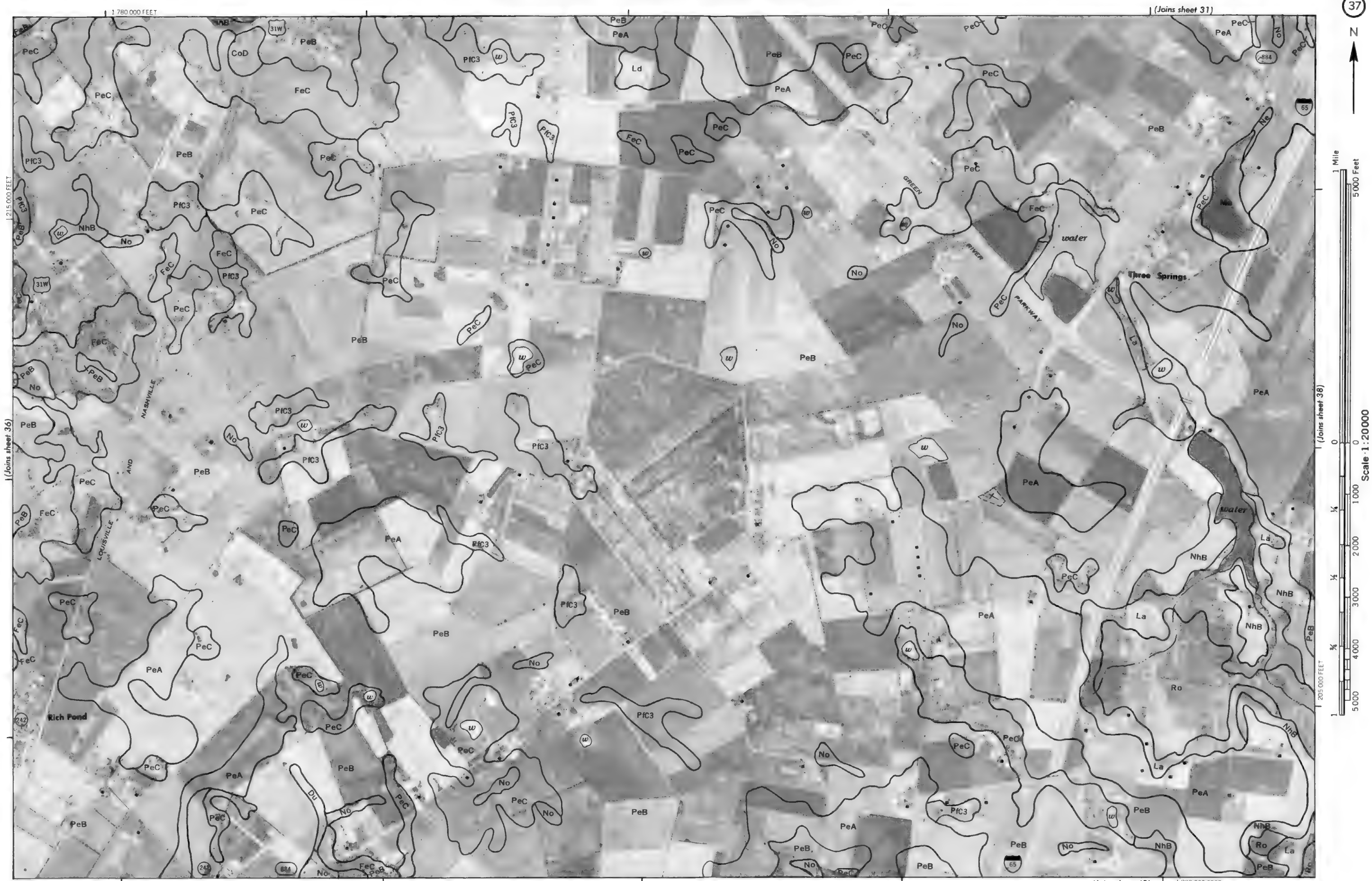

WARREN COUNTY, KENTUCKY NO. 37

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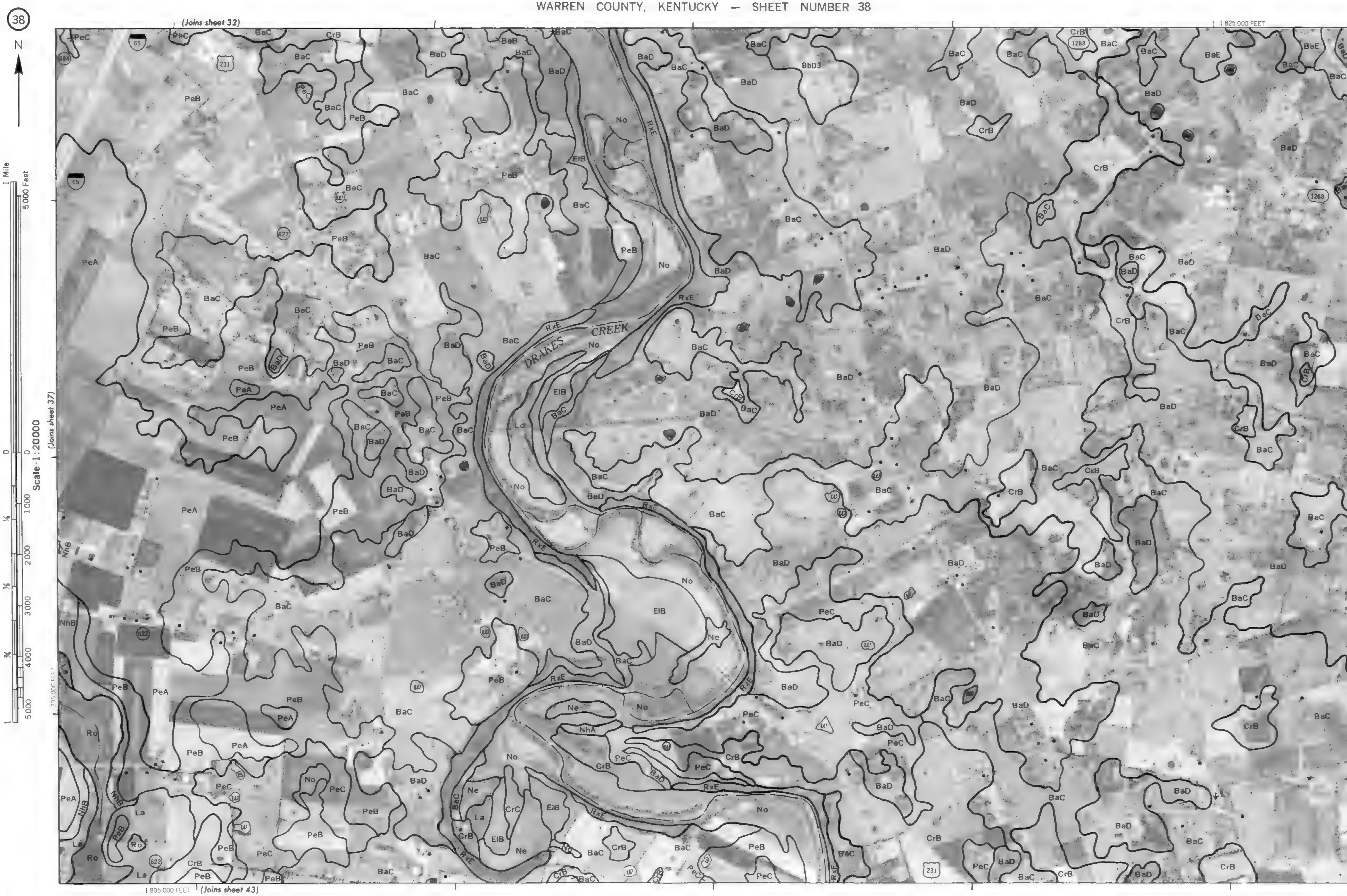
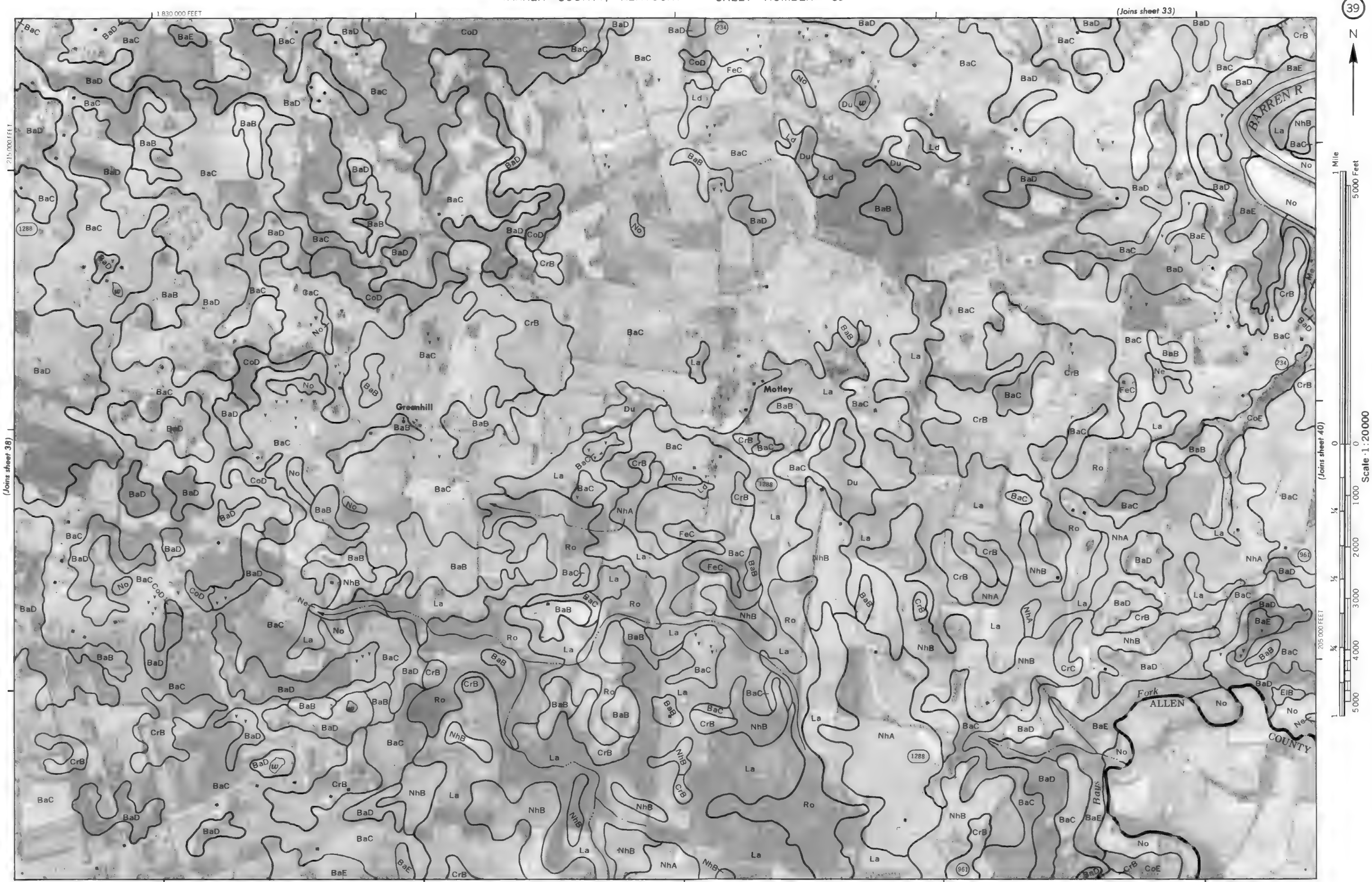


This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



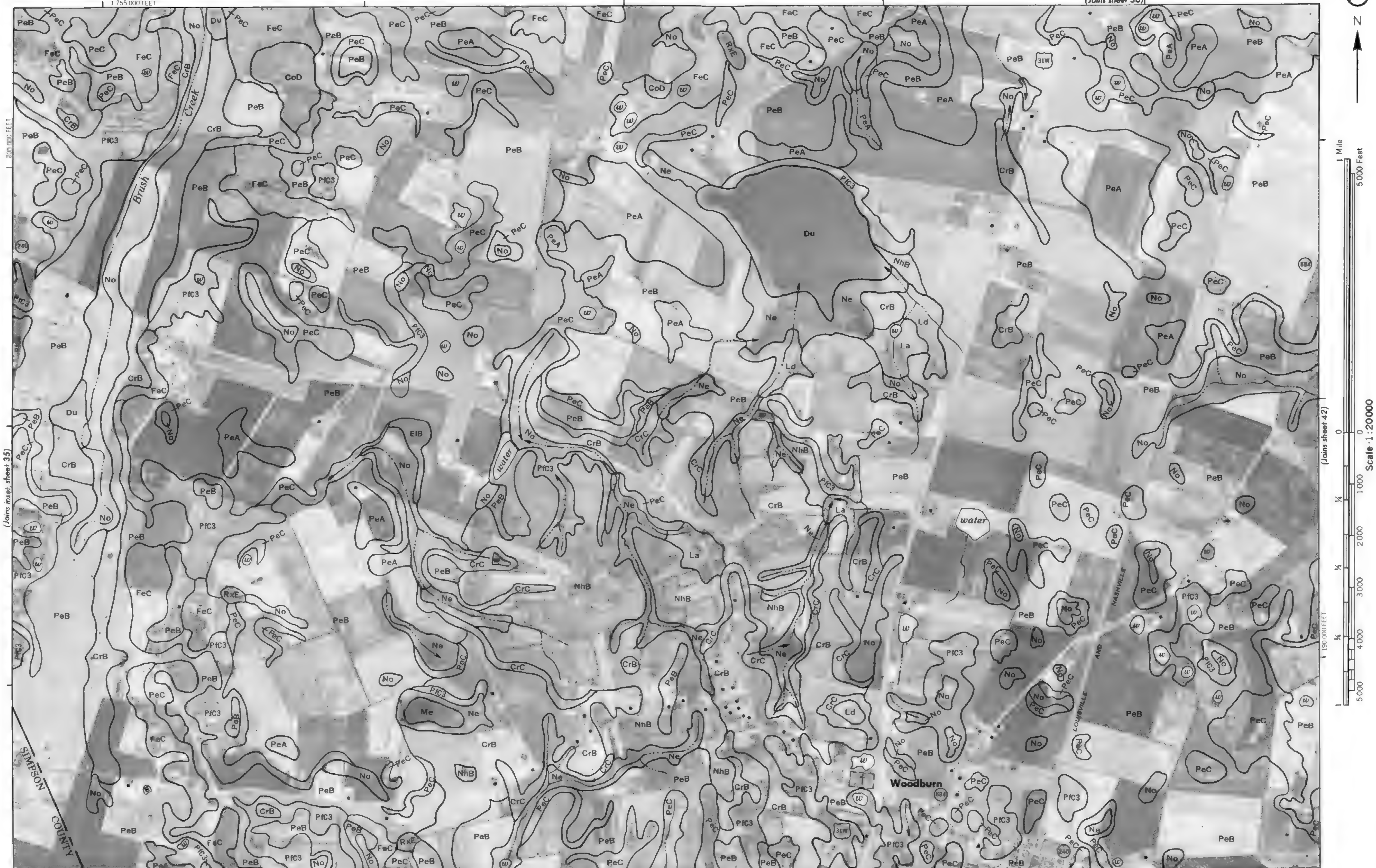
WARREN COUNTY, KENTUCKY NO. 39

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WARREN COUNTY, KENTUCKY — SHEET NUMBER 40

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

WARREN COUNTY, KENTUCKY NO. 40



WARREN COUNTY, KENTUCKY NO. 41

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

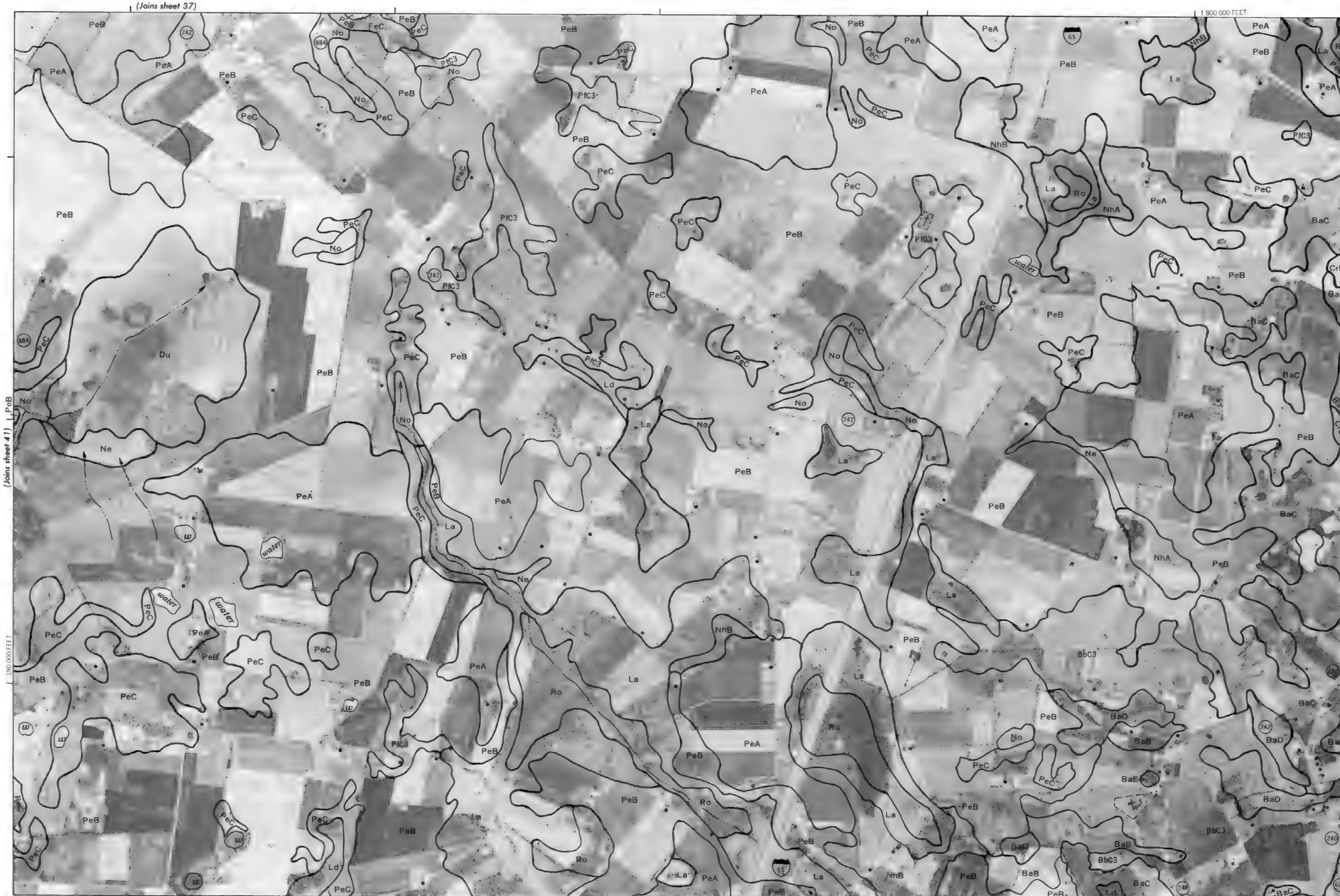
Scale 1:20000

1 Mile

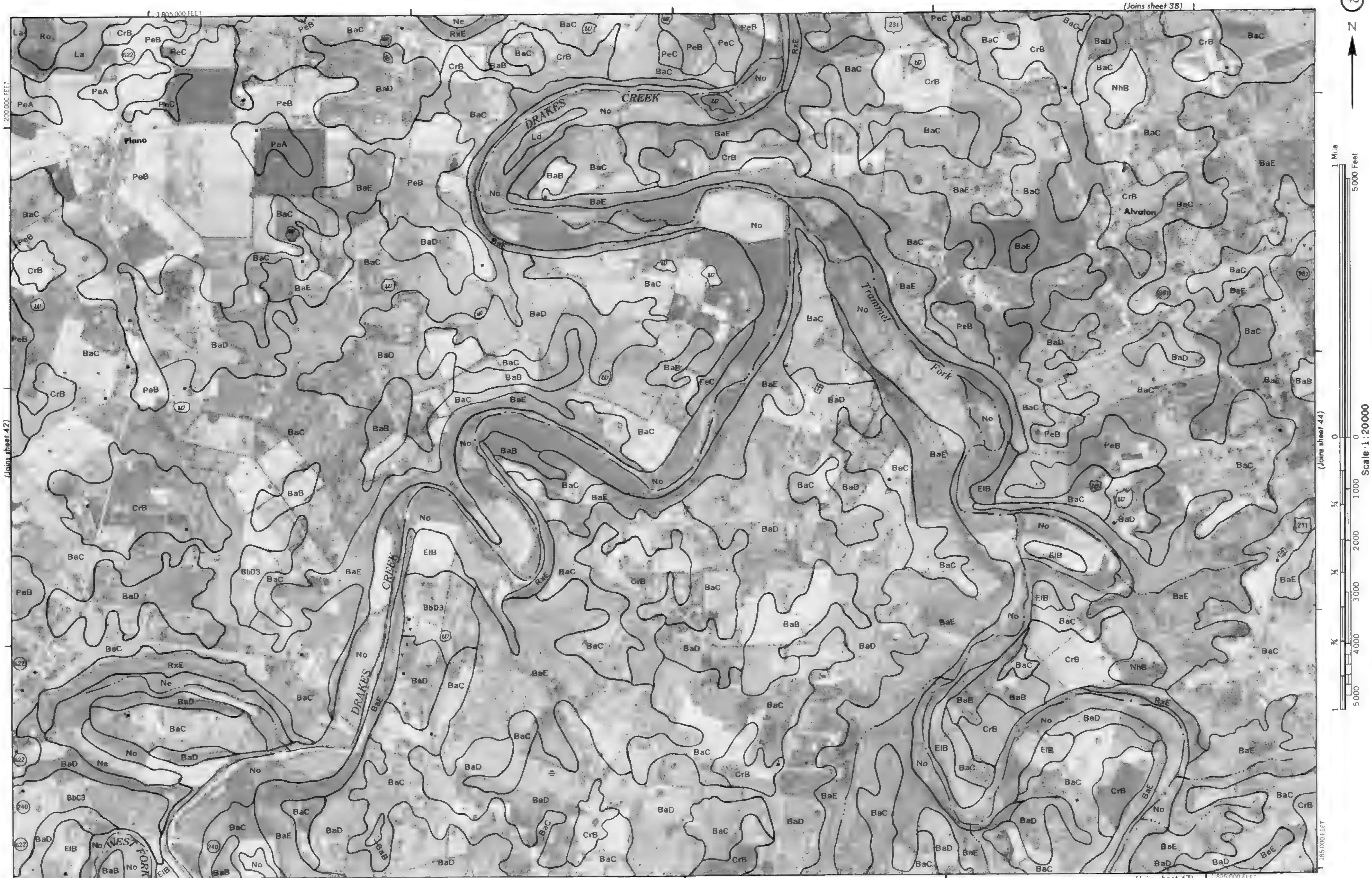
5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



WARREN COUNTY, KENTUCKY NO. 43

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WARREN COUNTY, KENTUCKY — SHEET NUMBER 44

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WARREN COUNTY, KENTUCKY NO. 44

WARREN COUNTY, KENTUCKY — SHEET NUMBER 45

(Joins sheet 41)

45

N

Scale 1:20000

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

WARREN COUNTY, KENTUCKY NO. 45

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WARREN COUNTY, KENTUCKY — SHEET NUMBER 46

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WARREN COUNTY, KENTUCKY NO. 47

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WARREN COUNTY, KENTUCKY — SHEET NUMBER 48

N

1 Mile
5000 Feet
0
Scale 1:20000
0 1000 2000 3000 4000 5000
¼ ½ ¾ 1

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WARREN COUNTY, KENTUCKY No. 48